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# NORTH AMERICAN

# MALLOPHAGA

BY

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*Professor of Entomology, Leland Stanford Junior University*

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LELAND STANFORD JR. UNIVERSITY
PALO ALTO, CALIFORNIA
1896

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# PREFATORY NOTE.

The two papers constituting this volume were published as nos. IV (March 17, 1896) and VII (November 12, 1896), respectively, of Contributions to Biology from the Hopkins Seaside Laboratory, a series of publications of the Leland Stanford Junior University, issued under the patronage of Mr. Timothy Hopkins. They were also published, by virtue of a co-operative arrangement between the University and the Academy, simultaneously in vol. VI of series 2 of the Proceedings of the California Academy of Sciences.

*LELAND STANFORD JUNIOR UNIVERSITY PUBLICATIONS*

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CONTRIBUTIONS TO BIOLOGY
FROM
THE HOPKINS SEASIDE LABORATORY
IV

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# NEW MALLOPHAGA,

## I,

### WITH SPECIAL REFERENCE TO A COLLECTION MADE FROM MARITIME BIRDS OF THE BAY OF MONTEREY, CALIFORNIA.

BY

VERNON L. KELLOGG,

*Associate Professor of Entomology, Leland Stanford Jr. University.*

( Reprint from the Proceedings of the California Academy of Sciences, Series 2, Vol. VI.)

LELAND STANFORD JR. UNIVERSITY,
PALO ALTO, CALIFORNIA,
1896.

## PREFATORY NOTE.

This memoir is the fourth of a series designed to illustrate the investigations and explorations of the Hopkins Seaside Laboratory, an adjunct of the biological laboratories of the Leland Stanford Junior University. The series is issued under the patronage of Timothy Hopkins, Esq., of Menlo Park, California. The present paper is published with the co-operation of the California Academy of Sciences, appearing simultaneously in its present form and as part of the Proceedings of the Academy.

CHARLES H. GILBERT,
OLIVER P. JENKINS,
Editors.

Date of publication, March 17, 1896.

# AUTHOR'S PREFACE.

The following paper presents the descriptions and figures of one new genus and thirty-eight new species of Mallophaga, together with the identifications and figures of twenty-two species previously described by European authors, but now, with few exceptions, first determined as parasites of American birds. All of these species have been collected, mostly by the author, from water and shore birds. As this is the first American general systematic paper on the Mallophaga, the author has thought it desirable, for the sake of making the study of the group more accessible to American students, to present some statement of the present knowledge of this little-known but interesting order of parasitic insects. To this end there is offered a brief account of the structure, external and internal, of the life-history and habits, and of the zoological and geographical distribution of the parasites, together with a review of the literature of the group, and a statement of the present systematic treatment of the order, with a synopsis and tables of the families and genera.

Types of the new species described will be placed in the collections of this University, in the collections of the California Academy of Sciences, and in those of the University of Kansas. The author has to express his obligations for services kindly rendered in connection with the preparation of this paper to President F. H. Snow and Librarian C. M. Watson of the University of Kansas; to Mr. Leverett M. Loomis, curator of birds for the California Academy of Sciences, whose aid in the collection and determination of birds is elsewhere referred to; to Miss Bertha M. Chapman, student of entomology; to Professor H. R. Fairclough, and to Miss Edna Hyatt, artist.

V. L. K.

Stanford University, February, 1896.

# NEW MALLOPHAGA, I,—WITH SPECIAL REFERENCE TO A COLLECTION MADE FROM MARITIME BIRDS OF THE BAY OF MONTEREY, CALIFORNIA.

(With Plates ii-xv.)

BY VERNON L. KELLOGG.

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## THE MALLOPHAGA—INTRODUCTION.

The Mallophaga constitute a small order of parasitic insects which live externally on the bodies of birds and mammals. The insects are small, one-tenth of an inch being perhaps an average length, wingless, and have biting mouthparts, with which they feed on the feathers or hair of their host, not sucking blood as the true lice do. They have an incomplete metamorphosis. The structure and habits of the insects have until recent years been very

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imperfectly understood—even yet the position of the group among insects is but provisionally established (see *postea)*, and the knowledge of the life history is strangely incomplete.

In America, besides some account of the commoner forms infesting domestic birds and mammals included in Professor Herbert Osborn's "The Pediculi and Mallophaga affecting Man and the Lower Animals" (Bull. No. 7, 1891, Div. of Ent., U. S. Dept. Agric.), and a discussion by Prof. A. S. Packard (Proc. Amer. Phil. Soc., 1887, vol. xxiv) of the position of the group among insects, practically nothing touching the systematic consideration of the group has been published.

## HISTORICAL AND BIBLIOGRAPHICAL.

EUROPEAN.—The Mallophaga are first recognizably mentioned in the writings of Redi (1668 and 1686), where the common *Trinoton luridum* of the ducks may be recognized in his "louse of the teal," and the common *Lipeurus baculus* of the pigeons is evidently the subject of his description of "*Pulex columbæ majoris.*" In the various writings of Albin (1720), Otto Fabricius (1780), J. C. Fabricius (1781, 1787, 1805), De Geer published in Germar's Magazin der Entomologie, vol. iii, 1818, Halle, presents the essential features of the classification of the group now used, and contains the earliest accepted nomenclature. Since the publication of this pioneer memoir four monographic works have been issued, together, needless to say, with numerous lesser memoirs containing descriptions of new species, compiled and more or less comprehensive conspecti of the group in text-books, and morphological treatises.

The monographs indispensable to the student of the Mallophaga are Henry Denny's Monographia Anoplurorum Britanniæ, or an Essay on the British Species of Parasitic Insects, 1842, London, illustrated with colored plates; Christoph Giebel's "Insecta Epizoa, die auf Säugethieren und Vögeln schmarotzenden Insekten, nach Chr. L. Nitzsch's Nachlass bearbeitet, mit XX Tafeln nach Nitzsch's Handzeichnungen," 1874, Leipzig; E. Piaget's "Les Pediculines, Essai Monographique, vol. i, Texte, vol. ii, Planches, 1880, Supplement, 1885," Leyden; and O. Taschenberg's "Die Mallophagen, mit besonderer Berücksichtigung der von Dr. Meyer gesammelten Arten," Nova Acta der Ksl. Leop.-Carol. Deutschen Akademie der Naturforscher, Band xliv, No. 1, 1882, Halle. Of these monographs Denny's is limited to a consideration of the parasites found on birds collected in England, his descriptions are too brief, and the colored figures too superficially drawn, so that it is often impossible to recognize from his description and illustration the species of parasite which he had under consideration. Giebel's monograph, as indicated in the title, is based on the unpublished descriptions and drawings of Nitzsch. Giebel also had access to the specimens collected and prepared by Nitzsch. The work is a monumental one, although many of the descriptions are incomplete, and the colored illustrations leave much to be desired in the way of accurate detail. Piaget's monographic essay is easily the most valuable treatise on the group, the descriptions being good, the uncolored figures in every way admirable, and the scope of the work truly monographic. Piaget has fairly attempted to include in his original essay a consideration of every species of Mallophaga described up to 1880. In his Supplement he publishes the descriptions of more than 100 new species which have come under his observation. Taschenberg's memoir is the first part of what he hopes to make a complete monograph of the group. It includes the genera *Goniodes*, *Goniocotes*, *Lipeurus*, *Ornithobius*, *Akidoproctus* and *Trichodectes*. The descriptions of new species are very complete, and the keys to species in the considered genera of great value; the illustrations only, though good, are not up to the exceptionally high standard of the work. Taschenberg, like Giebel, has had access to Nitzsch's types.

Of the lesser systematic memoirs Nitzsch's posthumous papers, edited by Giebel, in the Zeitschrift für gesammte Naturwissenschaft, vols. xvii, 1861, xviii, 1861, and xxviii, 1866, are the most important; all of their contents are, *Lipeurus jejunus* (Zeitschr. f. wiss. Zool., 1869, vol. xix, p. 452), of Melnikoff on the embryology of the Mallophaga and of the Pediculidæ (Archiv f. Naturgesch., 1869, vol. xxxv, p. 136), and of Grosse on the anatomy of *Tetraopthalmus chilensis* [=*Menopon titan*] with some comparative studies (Zeitschr. f. wiss. Zool., 1885, vol. xlii, p. 530), are the most important. A full abstract of Grosse's paper was published by Macloskie in the American Naturalist, 1886, vol. xx, p. 340, and is thus readily accessible to American students.

A few descriptions of new species have been published recently by Piaget (Tijdschr. v. Ent., and Notes of the Leyden Museum), and by Picaglia (Atti d. Soc. Ital. di Sci. Nat., and Atti d. Soc. dei Nat. di Modena).

I append a bibliographic list of the more important systematic and morphological memoirs. Full bibliographic lists are to be found in the monographs of Giebel and Piaget. A good list is that published by Picaglia at the beginning of his paper, "Pediculini dell'Istituto anatomo-zoologico della R. Università di Modena," Atti d. Soc. dei Naturalisti di Modena, 1885, serie 3, vol. iv.

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AMERICAN. As already mentioned in the Introduction, there are practically no American systematic papers on the Mallophaga excepting Professor Herbert Osborn's account of "The Pediculi and Mallophaga affecting man and the lower animals" (Bulletin 7, 1891, Division of Entomology, U. S. Dept. Ag.) Of this bulletin pages 30–54 treat of Mallophaga found on domestic mammals and birds, including the cat, dog, bear (sic), llama, goat, sheep, horse, mule, cow, guinea-pig, pouched gopher (sic), duck, goose, swan, chicken, pigeon, peacock, pheasant, guinea-fowl and turkey. Many of the species referred to in the bulletin have evidently been observed on animals in America by Professor Osborn, but just how many and what species are not told. One new species, *Trichodectes geomydis*, found abundantly on the Pocket Gopher, is described and figured. I find this species common on *Thomomys talpoides bulbivorous* in this State (California). Among the illustrations of the bulletin are twelve original ones, indicating that at least these twelve species have been personally observed by Professor Osborn.

In the American Monthly Microscopical Journal for November, 1894, Professor Osborn publishes a key to the genera, including in it all of the genera then known, excepting Westwood's *Ancistrona* and Taschenberg's *Eurymetopus* and *Bothoriometopus*.

In the American Naturalist, 1871, in a paper entitled "Certain Parasitic Insects," Professor A. S. Packard names, illustrates, and briefly describes seven new species of Mallophaga collected from American birds. Unfortunately neither the descriptions nor illustrations have been sufficient to enable any one of these species to be recognized by subsequent writers. Similarly Dr. Leidy in the Proceedings of the Academy of Natural Sciences of Philadelphia, refers in briefest terms to a *Menopon* these types wherever they are found." Dr. Burnett noted that "although there are single species (of parasites) peculiar to particular animals, there are others which are found on different species of the same genus as is the case in the parasites living on birds of the genus *Larus* (Gulls) and the diurnal birds of prey." From an examination of the structure of these animals, Dr. Burnett was of opinion that they should be placed in an order by themselves, closely allied to the Insecta; "they number about 250 species, the mandibulate parasites occupying the highest and the haustellate the lowest position in the order." In the second paper Dr. Burnett makes a curious argument for the theory of a special creation of each species of animal based on the facts shown in his study of the distribution of their parasites.

Prof. A. S. Packard read at the meeting of the American Philosophical Society, September 2, 1877, a paper "On the Systematic Position of the Mallophaga," which was published in the Proceedings of the Society, 1887, vol. xxiv, p. 264. Prof. Herbert Osborn has published in Insect Life, 1890, vol. iii, p. 115, a "Note on the Period of Development in Mallophaga," and in the same journal, 1891, vol. iv, p. 187, a paper on the "Origin and Development of the Parasitic Habit in Mallophaga and Pediculidæ."

I append a list of the American papers.

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## STRUCTURE.

EXTERNAL.—The characteristic external appearance of the Mallophaga is due to a structural condition incident to the parasitic habits of the insects. The body is small, wingless, greatly flattened and usually strongly chitinized. There are no indications of wings in any stage of the insect's life.

*Head* (fig. 7, plate ii). The head is large in proportion to the whole size of the body, flat (slightly convex above and slightly concave below), and variously cresored plate, whose anterior margin, variously notched, roundly emarginated, truncated or convex, forms the frontal line of the head. The suture separating the clypeus from the epicranium is usually distinct or unmistakably indicated, sometimes indistinguishable. The hind-head is usually widest across the temporal region, the temples often being strongly expanded laterally with angulated or rounded margin. The occipital region is usually concave, so that the head sits "hat-like" on the prothorax. The head presents certain chitinous bands projecting forward from the occipital margin, inwardly from the eyes, forward from the bases of the antennæ, etc. The presence or absence and the character of these bands are used as distinguishing specific characters, and the bands are named and defined in the Terminology (see *postea*).

The antennæ (figs. 10, 11 and 12, plate ii) are short, 3-, or 4-, or 5-segmented and vary much in shape and character. They are filiform (suborder Ischnocera) or clavate or capitate (suborder Amblycera), and sometimes differ in the two sexes of the same species. When this is the case they are the antennæ of the male which depart from the typical condition, showing appendages on one or more segments, probably used for grasping the female. The antennæ arise from or near the lateral margins of the head, and usually from about the middle of the margin. The fossa may be deep or shallow; its angles projecting and acute or short and rounding; and the antennæ may project directly and always from the head (suborder Ischnocera) or they may lie concealed in excavations on the under side of the head (suborder Amblycera).

The eyes are simple and are located in the lateral margins of the hind-head not far behind the antennary fossæ, in a deep or shallow ocular emargination of the lateral margin, or on the non-emarginated margin. They are two in number, although each is sometimes slightly or almost completely divided by an angular emargination. They are flatly convex to hemispherical, and clear to strongly colored.

The mouth parts (figs. 7, 8, 9, plate ii), situated on the under side of the head, and variously from the middle of this aspect to the frontal margin, are fitted for biting and consist of rather large, strongly chitinized, usually two-toothed, usually sharply pointed mandibles, inconspicuous and as yet imperfectly known maxillæ without palpi, and a labium of various character and size; either large and with 4-segmented palpi (family Liotheidæ) or small and without palpi (family Philopteridæ). Despite the good work of Grosse the knowledge of the mouth parts of the Mallophaga is still manifestly incomplete.

*Thorax.* The thorax, which is composed usually of but two segments (three in but three genera), the meso- and metathorax being indistinguishably coalesced, is flat, larger than broad, and variously shorter than the head to much longer than the head (in one species as long as the abdomen). The lateral borders of both sclerites are strongly chitinized. The metathorax sometimes closely resembles an abdominal segment and is often closely joined project upwards, being undoubtedly tactile organs. In the case of the three genera in which the mesothorax can be distinguished from the metathorax, this separation is especially evident in immature specimens, as would be expected in the case of a specialization by reduction.

The legs (fig. 13, plate ii) are strong and of variable length; the forelegs are the shortest and are used as foot-jaws for carrying food to the mouth. When at rest the forelegs project forward beneath the head. The coxæ are usually short (long and projecting beyond the lateral margins of the thorax in one genus) and are rarely appendaged. The femora vary from long, subcylindrical, to short, thick, subovoid; the tibiæ are usually shorter than the femora (sometimes as long, rarely longer) and slender, and are armed at the distal extremity with spines and sometimes, in the males, with special structures for holding the female. Both femora and tibiæ bear from a few to many short to long hairs; sometimes series of short, strong spines. The tarsi are 2-segmented, the distal segment with one (mammal-infesting forms) or two (bird-infesting forms) claws, the first segment of the tarsus is short and with or without one or two small lobes; the second segment is short (family Philopteridæ) or elongate and slender (family Liotheidæ) and bears a pulvillus between the claws.

*Abdomen.* The abdomen is flat, short, oval to long and slender, often differs in the sexes, especially in the shape and character of the posterior margin of the last segment, and is composed of 9 (sometimes apparently 8) or 10 segments. It may be almost naked or pretty thoroughly clothed with hairs, and bears almost always one to several short to long hairs in the posterior lateral angles of each segment, which angles sometimes project acutely. The hairs on the dorsal surface, as on the [illegible] mal, [illegible] [illegible] [illegible] [illegible] mandibles. The [illegible] [illegible] elongate, [illegible] with [illegible] margin, which is [illegible] [illegible] [illegible] long hairs. The [illegible] [illegible] [illegible] [illegible] usually [illegible] [illegible]

[illegible] knowledge of the [illegible] [illegible] [illegible] [illegible] [illegible] the points of [illegible] [illegible] [illegible] structure are the [illegible] and the differing [illegible].

*A. [illegible]* [illegible] figs. [illegible] and [illegible] plate I. The esophagus of the [illegible] [illegible] expands [illegible] to form a crop; in the [illegible] the crop appears as a conspicuous diverticulum or [illegible] of the esophagus. The crop often bears spines or teeth on its inner wall. There are two pairs of salivary glands, variously cylindric, elongate, [illegible], reniform, or divided into many small cylindrical tubes. The stomach usually presents some forward-projecting sac-like expansions. There are four thread-like, unbranched, Malpighian tubules.

*jejunus* to be a long delicate tube with expanded, turnip-like, posterior extremity. The "wing-muscles" are greatly reduced. There are but four openings for the ingress of the blood, which is not rich in white corpuscles. Wedl was able to study the heart of *Menopon pallidum*, but Grosse could not succeed in making preparations showing the heart of *Tetraopthalmus chilensis* [=*Menopon titan*].

*Respiratory System* (fig. 6, plate ii). In *Menopon titan* I have found six pairs of abdominal spiracles (segments 3–8) and a pair of prothoracic spiracles. There are two large longitudinal trunks and one large transversal trunk (segment 4 of the abdomen) in *titan.*

*Nervous System* (fig. 3, plate ii). There are two head ganglia, the supra-œsophageal and the infra-œsophageal, and three thoracic ganglia lying close together. There are no abdominal ganglia, the hindmost thoracic ganglion sending back into the abdomen two large nerves, whose branches provide the abdominal viscera with nerves.

## LIFE-HISTORY AND HABITS.

The Mallophaga have an incomplete metamorphosis. The eggs are elongate-oval, are fastened singly by some gluey substance to the vanes or barbs of the feathers, and the young issue by breaking off a circular cap or lid at the larger free end of the egg. The duration of the egg stage has not been determined for any species. A number of eggs of *Nitzschia pulicare* (host, the Chimney Swift, *Chætura pelasgia)*, collected by P. H. Rolfs (Ames, Iowa), and kept, some of them, "in a tight pasteboard box in his vest-pocket, the others enclosed in cotton-plugged tubes under a setting hen," incubated under these circumstances in from 13 to 20 days. The age of the eggs at time of collecting was not known. The young resemble the parents in essential characters; the noticeable differences are the comparatively larger head, the smaller, especially shorter, abdomen, and the absence or incompleteness of the markings, especially those of the abdomen. The color of the very young is always whitish; as they grow older chitinization follows and the brown and black colors appear (see plates). The number of moults or the duration of immaturity is not known for any species. I have observed nymphs (presumably in the stage preceding the final moult) which were fully as large as the adults of the same species. I have figured the immature stages for one or more species in nearly all the genera met with by me on the water and shore birds (see plates). In none of the monographic works is there any attention paid to the young. From the preceding brief account it is obvious that the life-history of the Mallophaga is as yet practically unknown.

*Parasitism.* The parasitic habits of the Mallophaga have been the subject of some little study, mainly directed to ascertaining whether or not the blood of the host ever forms a part of the food of the parasite. From the condition of the mouth parts and from repeated examination of the contents of the crop the food of the Mallophaga is affirmed to be the epidermal scales and the hair or feathers tion, it would be wanting. A few instances are recorded of the presence of blood in the crop, but it has been suggested, with much show of probability, that the blood was such as might not infrequently, because of wounds, be found by the parasite on the feathers, perhaps dried and hard. There is one instance, however, known to me among the habits of the parasites which cannot be so readily explained. *Menopon titan* var. *linearis* of the California Brown Pelican *(Pelecanus californicus)* is found commonly clinging to the inner surface of the gular pouch. The clinging is accomplished by the use of the mandibles, each parasite of the half dozen individuals which may be grouped together having its mandibles inserted in the skin of the pouch. The mandibles are not thrust in suddenly on touching the insect with the collecting forceps, but the insects are always, as far as observed, firmly lodged. Indeed some effective clinging would be necessary always to prevent the carrying away of the parasites by the water taken into the pouch of the pelican in feeding. In several instances a small region surrounding the parasites was raw and bloody. What is it that serves these parasites for food? Perhaps, of course, simply the epidermal scales of the inner wall of the pouch.

The abundance of certain species of Mallophaga, like *Menopon pallidum*, on domestic poultry causes the hosts much inconvenience and sometimes actual injury. The injury is done by the irritation of the skin of the host by the sharp-clawed feet of the hordes of parasites, rather than by any direct hurt through the feeding. After the death of the host, the parasites either attempt to leave the body, usually migrating slowly toward the head, or simply die on the body. The death of the parasites remaining on the body usually ensues in two or three days. I have observed the death of some in four or five hours, [illegible] the other and [illegible] the parasites from [illegible]. The [illegible] of the parasites [illegible] of their feeding [illegible] rather than be attributed to the lack of [illegible] they have been accustomed to during the life of the host.

[illegible] both swimming and diving birds are not provided with special contrivances for their [illegible]. There is [illegible] never come necessarily into contact with the water, living as they do, in the bases of the feathers where the water can never penetrate and where they have a constant and sufficient supply of air for the longest submergence possible to the host.

The origin of the parasitic habit among the Mallophaga and its influence on their structure are questions of much interest, but ones which cannot be touched on here.

Some of the phenomena of the relations of parasites to hosts, the migration of the parasites, and the influence of their peculiar habits in the [illegible] establishing of variations, are considered in the following paragraphs under the head of "Distribution."

## DISTRIBUTION.

may be readily accomplished: (a) from male to female, or *vice versa*, during copulation; (b) from parent to young, during the nesting season. In both of these cases there is actual contact of the hosts. If at other times in the life of the host it comes into actual contact with other birds of its own species migration of parasites can take place. Such cases must occur among birds of gregarious habits; the crowding together of gulls on small masses of floating sea-weed, or on masses of food, or on the rocks of the shore, must bring about actual contact of the bodies of the birds. But, as common observation shows, there are in the crowding groups of gulls individuals of different species. Thus in these cases there is possible a migration of parasites from one bird-species to another, these species in the case of the gulls being closely related ones—species belonging, in fact, to one genus. But on the "roosts" of maritime birds, the cliffs of the shore and the outlying rocks, birds of very different kinds sit huddled together. Along the rocky shores of Point Pinos on the Bay of Monterey, pelicans, cormorants and gulls gather in great numbers and perch side by side on favorite "roosts." It seems as if migration of parasites from one to another of these bird-species could here, and elsewhere under similar conditions, often be accomplished; and I have found *Lipeurus toxoceras*, described by Nitzsch from a cormorant, on both a cormorant and a pelican shot on this shore. Other cases of contact occur between birds of prey and their victims (I have noted a *Physostomum*, a genus confined normally to passerine birds, on a sparrow-hawk); and in those few groups of closely allied forms among which hydridization occurs, as with the ducks. Still other opportunities for accidental or normal contact between birds of different species will suggest themselves to the student.

The opportunities for migration so far referred to are sufficient to account for the spreading of a parasite species among individuals of its host species, and for the condition presented in cases like those of *Docophorus lari* and *Nirmus lineolatus* common to many species of gulls, and those of *Trinoton luridum* and *Docophorus icterodes* common to many species of ducks: cases where the birds are of gregarious habits, or where hybridization occurs.

But of those cases of a parasite common to two or more bird-species, one or more of which are Old World forms and the other or others New World forms, a further explanation is necessary. In this paper I ascribe to Mallophagous species described from specimens taken on birds of Europe or elsewhere not on the American continent specimens of twenty-two different species of Mallophaga taken on American birds. Examples of such occurrence are *Nirmus signatus* and *N. pileus* from the American Avocet *(Recurvirostra americana)* and described by Piaget and Nitzsch from specimens taken on the European Avocet *(Recurvirostra avocetta)*; *Docophorus pertusus* from *Fulica americana* (America), originally described from *Fulica atra* (Europe), and so on. In rare instances we find a bird-species common to both the Old World and the New World: certain birds of circumpolar range, species of Mallophaga referred to in this paper as being taken on American birds one-third are referable to species previously described from European or Asiatic birds), must have another explanation than any yet suggested. This explanation, I believe, is, for many of the instances, that the parasitic species has persisted unchanged from the common ancestor of the two or more now distinct but closely allied bird-species. With the spreading of the ancestral bird-species, geographical races have arisen within the limits of the species which have, with time and isolation caused by newly appearing geographical barriers (due to geologic or climatic changes), come to be distinct species—species often distinguished only by superficial differences in color, etc. The parasites have remained practically unaffected by the conditions which have produced the differences among the birds; the temperature of the host's body, the feathers *as food*, all of the environment is essentially unchanged in its relation to the parasite. The parasitic species thus remains unchanged, while the first *Larus* species or *Anas* species becomes differentiated into a dozen or score of specific forms, all with a common parasite.

In substantiation of this explanation of a common possession of a parasitic species by Old and New World birds some examples may be referred to. As already mentioned, I have found on *Fulica americana* the same species of parasite, *Docophorus pertusus*, described by Nitzsch from specimens taken from the European *Fulica atra; Docophorus melanocephalus* taken by me on *Sterna maxima* is recorded by European authors from *Sterna caspia* and *S. cantiaca; Nirmus punctatus*, found by me on *Larus occidentalis* was described by Nitzsch from *Larus ridibundus* and has been found by Piaget on *Larus dominicans* from Chile and on *Larus ichthyætus* from the

Volgas; *Nirmus signatus* and *N. pileus* found by me on *Recurvirostra americana* were described by Piaget and Nitzsch respectively from *Recurvirostra avocetta*, the European Avocet; *Lipeurus ferox* taken by me on *Diomedea albatrus* is recorded by European writers from *Diomedea exulans*, *brachyura* and *melanophrys*; *Lipeurus forficulatus* taken by me on *Pelecanus erythrorhynchus* and *P. californicus* was described by Nitzsch from *P. onocrotalus*; and similarly the most of the twenty-two previously described species taken by me from American birds might be thus offered as examples. We have in all of these cases the common parasite occurring on the American representatives of the genus to which the original Old World host belongs. Looking now for the exceptions to this condition—namely, for instances where the known species when found on an American bird is found on one widely separated phyletically from the European host—we find no clearly defined instance of this condition, no instance where association during life or "straggling" after death of the host can be put aside as possible explanations of the presence of the parasite on the unexpected host.

There are to be noted other results of the influence on the taxonomy of the Mallophaga of the peculiar condicrossing among less closely related individuals. For example the individuals of a parasite species on a bird of long life and non-gregarious and monogamous habits, like an eagle, live very much the life of an isolated community. There must be many years of in-and-in breeding. It is like island life. The result is certain: the members of this isolated group will soon differ from the specific type in noticeable particulars. On the other hand, the conditions of life on this "island" are practically identical with the conditions on other similar "islands"—other eagles—inhabited by other individuals of the same parasite species, so there is no influence working to produce a wide divergence of the members of these various isolated groups of individuals of the same species. Now this isolation of groups of individuals is in some degree an incident of the life of all Mallophaga; in some instances it is considerable; in others, inconsiderable, but taken altogether a condition in the life of the whole order exerting an influence which has the readily recognizable result of creating a great number of small variations within species limits.

We have noted now two influences resulting from the peculiar habits of the Mallophaga which are somewhat opposed to each other. One influence, due to the uniform (as far as relation to parasite goes) conditions of the habitat, the body of the host, tending to preserve essentially unchanged the type-forms of the parasites; the other influence, due to the isolation of groups of individuals and the consequent close breeding, tending to foster and fix small variations. The results, manifest to any student of the group, are to render difficult the division of the order into distinct genera on account of the general similarity of structure, and to make difficult the definition of species on account of the many slight variations among the individuals from different bird individuals. While I believe myself able to refer specimens taken from American birds to a score of species described from specimens taken from European and Asiatic birds, in all of these instances there are slight but recognizable differences between the American specimens and the type-forms of the species (as well as I am able to make comparison, having only the drawings and descriptions of these type-forms to refer to).

The differences in relative abundance or rarity of the individuals of a species, and in the relative freedom or seriously infested condition of the hosts may be referred to briefly. Certain specific examples will serve to illustrate the various conditions. In the first place the host species may have several parasitic species as *Diomedea albatrus*, *Fulmarus glacialis* vars. *glupischa* and *rodgersii* and *Fulica americana*, each with six species of parasites; or the host species may have but one (very rarely) or two or three parasitic species infesting it, as with most of the ducks and gulls. A parasitic species may be constant in its appearance on the individuals of its host species, as *Docophorus lari*, almost certain to be found on any gull specimen shot, *Lipeurus celer*, which I found on twenty-nine out of thirty specimens of *Fulmarus glacialis* vars.

from a single bird, and which is always abundantly present on its host; or the individuals may be few even though the parasite is a constant one, *i. e.*, almost always to be found on any specimen of the host examined. *Trinoton luridum* of the ducks is a good example of this constant presence in small numbers. There may be more than one species of the same genus of parasites on a single host, as *Lipeurus celer* and *Lipeurus varius*, both numerous on the Fulmars; but usually the different parasites of a host represent different genera, exemplified by the remaining four species of parasites of the Fulmars which belong to four other and different genera.

Finally, I may append to these desultory remarks concerning the distribution of the Mallophaga and the influence on their taxonomy of their peculiar habits of life a list of those bird hosts with their parasites, the examination of which has afforded the data for this paper. In preparing the list I have eliminated all instances of undoubted "straggling."

### LIST OF HOSTS WITH PARASITES.

- Colymbus nigricollis californicus.
  - Docophorus lari.
    - kansensis.
  - Menopon tridens var. insolens.
- Urinator pacificus.
  - Docophorus colymbinus.
    - graviceps.
  - Oncophorus advena.
  - Menopon tridens var. pacificum.
- Urinator lumme.
  - Docophorus colymbinus.
    - lari.
    - graviceps.
  - Nirmus farallonii.
- Ceratorhina monocerata.
  - Docophorus acutipectus.
- Ptychorhampus aleuticus.
  - Docophorus montereyi.
  - Menopon loomisii.
- Synthliborhampus antiquus.
  - Docophorus montereyi.
    - atricolor.
  - Menopon loomisii.
- Brachyrhampus marmoratus.
  - Docophorus montereyi.
    - atricolor.
- Uria troile californica.
  - Docophorus calvus.
- Rissa tridactyla pollicaris.
  - Docophorus lari.
- Larus glaucus.
  - Docophorus lari.
- Larus glaucescens.
  - Docophorus lari.
  - Nirmus lineolatus.
  - Colpocephalum funebre.
  - Menopon infrequens.

- Larus occidentalis.
  - Docophorus lari.
  - Nirmus lineolatus.
    - punctatus.
- Larus argentatus smithsonianus.
  - Docophorus lari.
  - Nirmus lineolatus.
- Larus vegæ.
  - Docophorus lari.
  - Nirmus lineolatus.
- Larus californicus.
  - Nirmus lineolatus.
- Larus delewarensis.
  - Docophorus lari.
  - Nirmus lineolatus.
    - punctatus.
- Larus brachyrhynchus.
  - Docophorus lari.
  - Nirmus lineolatus.
- Larus canus.
  - Docophorus lari.
  - Nirmus lineolatus.
- Larus heermanni.
  - Docophorus lari.
  - Nirmus lineolatus.
    - felix.
- Sterna maxima.
  - Docophorus melanocephalus.
  - Nirmus præstans.
    - hebes.
    - lineolatus.
- Fulmarus glacialis glupischa.
  - Docophorus occidentalis.
  - Lipeurus celer.
    - varius.
  - Eurymetopus taurus.
  - Ancistrona gigas.
  - Menopon numerosum.
- Fulmarus glacialis rodgersii.
  - Docophorus occidentalis.
  - Lipeurus celer.
    - varius.
  - Eurymetopus taurus.
  - Ancistrona gigas.
  - Menopon numerosum.
- Puffinus opisthomelas.
  - Lipeurus diversus.
    - limitatus.
    - testaceous.
  - Giebelia mirabilis.
- Puffinus griseus.
  - Lipeurus diversus.
    - limitatus.
  - Giebelia mirabilis.
- Phalacrocorax dilophus albociliatus.
  - Docophorus lari.
  - Nirmus farallonii.
  - Lipeurus toxoceras.
- Phalacrocorax penicillatus.
  - Nirmus farallonii.
- Pelecanus erythrorhynchus.
  - Lipeurus forficulatus.

- Merganser serrator.
  - Docophorus icterodes.
  - Lipeurus temporalis.
    - squalidus.
- Merganser americanus.
  - Lipeurus squalidus.
  - Trinoton luridum.
    - lituratum.
- Anas boscas.
  - Docophorus icterodes.
  - Trinoton luridum.
    - lituratum.
- Anas americana.
  - Trinoton luridum.
- Anas carolinensis.
  - Trinoton luridum.
- Spatula clypeata.
  - Trinoton luridum.
- Dafila acuta.
  - Docophorus icterodes.
  - Trinoton luridum.
    - lituratum (?)
- Aythya americana.
  - Docophorus icterodes.
- Aythya affinis.
  - Docophorus icterodes.
- Charitonetta albeola.
  - Lipeurus squalidus.
- Oidemia deglandi.
  - Docophorus icterodes.
- Oidemia perspicillata.
  - Docophorus icterodes.
  - Lipeurus constrictus.
- Erismatura rubida.
  - Docophorus icterodes.
    - pertusus.
  - Trinoton luridum.
- Ardea egretta.
  - Colpocephalum laticeps.
- Fulica americana.
  - Docophorus pertusus.
  - Lipeurus picturatus.
    - longipilus.
  - Oncophorus advena.
  - Laemobothrium atrum.
  - Menopon tridens var. pacificum.
- Recurvirostra americana.
  - Nirmus signatus.
    - pileus.
  - Colpocephalum uniforme.
  - Menopon indistinctum.
- Charadrius squatarola.
  - Docophorus fuliginosus.
- Charadrius dominicus.
  - Nirmus orarius.
  - Colpocephalum timidum.

## POSITION AMONG INSECTS.

What the position of the Mallophaga among insects is, is still a moot question, as indeed, strictly speaking, is the position of any one of the groups. The Mallophaga by reason of their habits have been constantly associated in entomological literature with the Pediculidæ. It is hardly worth while here to trace the Mallophaga in their tortuous path through the various schemes of insect classification from the times of Redi to the present day. It has not been until comparatively recent years that the facts of structure and life history upon which the classification of any group depends were known in the case of the Malloized, of a racial condition, but of a specialization, albeit in the line of reduction or degradation. With the simple general structure there goes a highly concentrated nervous system, greatly modified mouth parts, and curiously specialized antennæ.

The thorough study of the life-history, embryonic and postembryonic, is needed to throw more light on the position of the Mallophaga. Till such study is made, the present isolated position assigned the group, based on the known structure of the adult and on its habits, may be accepted as representing the consensus of authority.

## CLASSIFICATION.

The Mallophaga were divided by Nitzsch into two families, the Philopteridæ, with filiform antennæ and without maxillary palpi, and the Liotheidæ, with capitate 4-segmented antennæ and maxillary palpi. The family Philopteridæ included two genera, *Trichodectes*, with 3-segmented antennæ and 1-clawed tarsi, and *Philopterus*, with 5-segmented antennæ and 2-clawed tarsi. The latter genus was subdivided into the five subgenera, *Docophorus*, *Nirmus*, *Goniocotes*, *Goniodes*, *Lipeurus*. The family *Liotheidæ* similarly included two genera, *Gyropus*, with 1-clawed tarsi, and *Liotheum*, with 2-clawed tarsi. The latter genus was subdivided into six subgenera, *Eureum*, *Læmobothrium*, *Physostomum*, *Trinoton*, *Colpocephalum* and *Menopon*. The two 1-clawed genera *Trichodectes* and *Gyropus* were found by Nitzsch exclusively upon mammals; all the other genera exclusively upon birds.

In essential identity the classification of to-day is that of Nitzsch; it differs in discarding the generic groups *Philopterus* and *Liotheum*, and in considering the Nitzschian subgenera as genera, and in the addition of several new genera.

That change by which the one-time subgenera of *Philopterus* are now put on equality with the genus *Trichodectes*, and similarly the subgenera of *Liotheum* on equality with *Gyropus*, seems to me ill-advised. The two genera found on mammals differ so radically and in so many ways from their related genera in each family that I believe their striking host and structural differences should be emphasized in the classification. I propose, therefore, in the light of the present position of the Mallophaga as an independent order of insects, to rank the Nitzschian families as suborders, and the Nitzschian genera as families, and the Nitzschian subgenera, the genera of present day writers, as genera. This will leave unchanged the present generic names and ranking, but will restore the expression, first indicated by Nitzsch in his generic rankings, of differences between the mammalian parasites and the avian parasites. This re-ranking, which is practically a return to classification of Nitzsch, finds expression in the keys and synopses which I have arranged to receive all of the genera so far recognized.

Although the Mallophaga include already nearly 1000 described species there are but few genera and these genera are difficult to separate. In other words, the whole group is a series of closely related and intergradnot definitely answered by the key. In introducing into the key the genera which have been described since the making of the key used in the European monographs, I find naturally increasing difficulties; so I have accompanied the key with a synopsis of all of the described genera, calling attention to the characters which go to give any genus its peculiarly characteristic appearance. With the key and the diagnosis I hope that any genus can be satisfactorily determined. For definitions of the terms used in referring to various structures of the Mallophaga, see the Terminology, following the synopsis.

### KEY TO THE SUBORDERS.

A. With filiform 3- or 5-segmented antennæ, and no labial palpi. Suborder Ischnocera.

AA. With clavate or capitate 4-segmented antennæ, and 4-segmented labial palpi. Suborder Amblycera.

### KEY TO THE GENERA OF THE SUBORDER ISCHNOCERA.

A. With 3-segmented antennæ; tarsi with 1 claw; infesting mammals (family Trichodectidæ). Trichodectes N.

AA. With 5-segmented antennæ; tarsi with 2 claws; infesting birds (family Philopteridæ).

B. Antennæ similar in both sexes.

C. Front deeply angularly notched. Akidoproctus P.

CC. Front convex, truncate, or rarely with a curving emargination, but never angularly notched.

D. Species broad and short, with large movable trabeculæ (at the anterior angle of antennary fossa).

E. Forehead with a broad transverse membranous flap projecting beyond lateral margins of the head in the male, barely projecting in female. Giebelia Kellogg.

EE. Without such membranous flap. Docophorus N.

DD. Species elongate, narrow; with very small or no trabeculæ. Nirmus N.

BB. Antennæ differing in the two sexes.

C. Species wide, with body elongate-ovate to sub-orbicular.

D. Temporal margins rounded; last segment of abdomen roundly emarginated; antennæ of male without appendage, third segment very long. Eurymetopus Tasch.

DD. Temporal margins usually angulated; last segment of abdomen of male usually angularly emarginated with two points.

E. First segment of antenna of male large, sometimes with an appendage; third segment always with an appendage. Goniodes N.

EE. First segment of antenna of male enlarged, but always without appendage; third segment without appendage; last segment of abdomen always rounded behind. Goniocotes N.

CC. Species elongate, narrow, sides sub-parallel.

D. Third segment of antenna of male without an appendage. Ornithobius Denny.

DD. Third segment of antenna of male with an appendage.

E. Front deeply angularly notched. Bothriometopus Tasch.

EE. Front not angularly notched.

F. Antennae and legs long; a semicircular oral fossa. Lipeurus N.

FF. Antennae and legs short; oral fossa narrow, elongate, extending as a furrow to the anterior margin of the head. Oncophorus Rudow.

## KEY TO THE GENERA OF THE SUBORDER AMBLYCERA.

A. *Tarsi with 1 claw; infesting mammals* (family Gyropidae). Gyropus N.

AA. *Tarsi with 2 claws; infesting birds* (except *Boopia?*) (Family *Liotheidae.*)

B. *Ocular emargination distinct, more or less deep.*

C. *Forehead rounded, without lateral swelling; antennae projecting beyond border of the head.* **Colpocephalum N.**

CC. *Forehead with strong lateral swellings.*

CC. Sides of the head sinuous; forehead without labral lobes.
  D. Body very broad; metathorax shorter than prothorax. EUREUM N.
  DD. Body elongate; prothorax shorter than metathorax.
    E. Ocular emargination filled by a strong swelling; sternal markings forming a quadrilateral without median blotches. NITZSCHIA Denny.
    EE. Ocular emargination without swelling, hardly apparent or entirely lacking; median blotches on sternum.
      F. Very large; with two 2-pointed appendages on ventral aspect of hind-head; anterior coxæ with very long lobe-like appendages. ANCISTRONA Westwood.
      FF. Small or medium; without bi-partite appendages of hind-head. MENOPON N.

## SYNOPSIS OF MALLOPHAGA.

### Suborder ISCHNOCERA.

With the antennæ filiform, 3- to 5-segmented, sometimes differing in the sexes; no labial palpi.

### Family TRICHODECTIDÆ.

Characters of the single genus.

Genus *Trichodectes*. Infesting mammals; tarsi with one claw; antennæ 3-segmented, in some species differing in the sexes; legs thickly beset with hairs; female with a pair of bent appendages on the sides or ventral surface of the eighth abdominal segment.

### Family PHILOPTERIDÆ.

Infesting birds; tarsi with two claws; antennæ 5-segmented, not lying in an excavation on the under side of the head, but always projecting far beyond the sides of the head.

Genus *Docophorus* Nitzsch. (Plates iii and iv.) Body short and broad, head usually as wide across the temples as long, front broadly truncate or convex or slightly concave, rarely with a curving emargination; clypeus with distinct suture, often with a broad uncolored anterior and lateral margin; signature usually shield-shaped, with acuminate posterior angle; prominent movable trabeculæ reaching to or beyond end of the first antennal segment; antennæ similar in the sexes, with thick first segment, segment 2 the largest, and segments 3–5 subequal. Thorax with meso- and meta-segments completely coalesced; legs rather flattened, insertions approached; front legs smallest and usually concealed beneath the head. Abdomen usually oval, of nine segments of about equal length; last segment of male rounded, of female small and emarginated. Color and markings whitish on buffy ground, markings clear light brown to opaque dark brown, and even to black; head with antennal occipital bands; thorax with lateral borders; abdomen with lateral bands, darkest, and lateral transverse blotches, longest in male where they nearly meet on the median line. This genus has been found on birds of all the larger groups except the Gallinæ.

Genus *Giebelia* Kellogg. (Plate xi.) General characters of *Docophorus;* forehead (labrum?) with a broad transparent membranous flap extending across the ventral surface of head and projecting conspicuously beyond lateral margins of head in the male and but slightly in the

Genus *Akidoproctus* Piaget. Body slender, elongate, Nirmoid in general shape; front of clypeus with a deep median rectangular notch, clypeal suture not distinct; antennæ similar in the sexes, situated distinctly before the middle of the head, short; prothorax rectangular, meso- and metathorax fused, widest (except in one species) in front; abdomen with broad sutures and a longitudinal median uncolored line; slightly mesad of the lateral band there runs parallel with it on each side a second narrow transparent lateral band; the two last segments in both sexes abruptly narrower than the seventh and conical. But four species belonging to this genus have been described.

Genus *Eurymetopus* Taschenberg. (Plate xi.) Body broad, *Docophorus*-like; antennæ differing in the sexes; clypeus broad, truncate; anterior angles of antennary fossæ produced and pointed; metathorax short, broad, without indication of constriction between meso- and meta-segments; coxæ not projecting beyond lateral margins of thorax; posterior segment of abdomen broadly round with slight rounding emargination, deeper in female than in male. But three species of this genus are yet known, of which one is so aberrant that it should probably be made the type of a new genus.

Genus *Goniodes* Nitzsch. Body large and broad; head usually with temporal margin and outer occipital margin angulated; head often varying in form in the sexes; antennæ differing in the sexes, third segment of male always with appendage, first segment enlarged and sometimes with appendage; prothorax usually trapeziform, metathorax much larger, rounded laterally; abdomen usually broadly oval, lateral band broad. Color usually whitish or pale yellowish, the blotches tawny, the bands dark brown to black. Found only on Gallinaceous birds.

Taschenberg has given sub-generic names to certain pretty distinctly separable groups of species. These subgenera may be distinguished by the following table:

A. With rounded temporal and occipital corners. No appendage on third segment of male, or a very small one. *Stronglyocotes.*
AA. With angulated temporal and occipital corners.
  B. Antenna of male with segments 4 and 5 very short, third segment with appendage. Temporal angles weak. *Coloceras.*
  BB. Segments 4 and 5 of male antenna of ordinary size. Temporal angles distinct.
    C. Segment 3 of male antenna with appendage; segment 1 long and thick and sometimes with appendage. *Goniodes s. str.*
    CC. Segment 3 of male antenna without appendage (distal angle slightly produced); segment 1 without appendage. *Rhopaloceras.*

Genus *Goniocotes* Burmeister. General characters those of *Goniodes*, but usually smaller species, and with antennæ of male never appendaged; the antennæ differ but little in the sexes, the male sometimes having the first and second segments larger than in the female. The species of this genus are found on gallinaceous and columbine birds.

Genus *Ornithobius* Denny. Body elongate, narrow; head broad, rather quadrangular; clypeus with a frontal emargination expanded within so that the bounding sides are pincer-like in shape, the points almost meeting, thus sides subparallel; head about as long as wide, with swelling rounded temples; clypeus including most of the forehead; without antennal bands, and with a deep angular frontal emargination or notch (much as in *Akidoproctus);* antennæ situated in front of middle of head and differing in the sexes; the antenna of male long, first segment thickened and as large as all the others together and with a pointed projecting process; antenna of female short, first two segments of equal length; legs very long, abdomen of both sexes with posterior segment 2-pointed behind. But one species has been described, taken from *Palamedea.*

Genus *Lipeurus* Nitzsch. (Plates vii, viii, ix and x.) Body long, slender; head usually narrow, elongate, with rounded temporal margins; clypeus usually with distinct signature, and with distinct or indistinct suture; antennæ differing in the sexes, the male antenna with first segment long and thick, rarely with appendage; third segment has an appendage, which is sometimes small and inconspicuous; the female antenna is simply filiform with first segment the thickest and second segment the longest; metathorax usually at least twice as long as the prothorax, often showing a lateral constriction indicating the line of fusion of meso- and meta-segments; the legs arise far apart, the proximity of the coxal cavities of the second and third pairs of legs to the thoracic margins being one of the diagnostic characters of the genus; the coxæ are long and project conspicuously beyond the lateral margins of the thorax; abdomen elongate and narrow, with segments 8 and 9 fused. Body color, white to brown, with conspicuous markings of pale brown to black. There are many described species and they have been found on all kinds of birds, being especially common on swimmers and rare on passerine birds.

Genus *Oncophorus* Rudow. (Plate xi.) (The generic name *Oncophorus* was proposed by Rudow for a species which has since been transferred to another genus, *Eurymetopus*, but Piaget, retaining the generic name, has grouped under it a number of species presenting the characters following. This genus "*sert de transition naturelle entre les genres Docophorus et Nirmus d'une part et les genres Goniodes et Lipeurus d'autre part.*" Usually small, 2 mm. being a maximum length among the known species; varying from broad to slender; head conical, clypeus with or without distinct suture, with or without signature; antennæ differing in the sexes, the male antenna longest, and the first three segments with or without appendages; prothorax but little shorter than the metathorax; legs short like those of *Nirmus*; color generally dark brown. But few species (eleven) so far described.

## Suborder AMBLYCERA.

With the antennæ clavate or capitate, 4-segmented, and with filiform 4-segmented labial palpi.

### Family GYROPIDÆ.

Characters of single genus.

Genus *Gyropus* Nitzsch. Infesting mammals, tarsi with distinct ocular emargination; eye located in the posterior portion of the emargination, simple or semi-divided by an emargination; temples usually swollen or "winged" with rounded or nearly straight lateral margin; just behind the eye and along the anterior margin of the temple a series of fine short hairs, the "ocular fringe"; the 4-segmented labial palpi extending beyond the lateral margins of the head; the 4-segmented antennæ with first segment short, cylindrical, second, conical, truncated, third goblet-shaped, fourth cylindrical or ovoid usually obliquely truncated; prothorax usually longer than metathorax, with produced lateral angles and bearing a pale or uncolored transverse line which does not extend into the lateral angular regions; mesothorax indicated by a slight constriction and sometimes by an uncolored transverse line across the metathoracic segment; first segment of tarsus short, with a small flat lobe or plate, second very long and slender; abdomen with nine segments, the posterior one differing in the sexes, with distinct dorsal and ventral posterior borders. Color whitish or yellowish with pale to dark brown markings. The genus contains many species, found on all birds except ostriches.

Genus *Boopia* Piaget. The single species upon which this genus is established by Piaget was found by him in company with individuals of *Colpocephalum truncatum* on *Phascolomys fossor*, a wombat! Can these true Liotheid forms have been stragglers from some bird host to this mammalian host? The characters of the genus, as shown by the one species, are: Body about 2 mm. long; head rounded in front, ocular emargination wide but shallow, situated more anteriorly than in other Liotheidæ; eye hemispherical, very large, located in the anterior portion of the ocular emargination; temples angularly produced; the palpi passing the margins of the head by three segments; the antennæ with second segment subspherical, third pedunculated, fourth the largest: thorax much as in *Colpocephalum;* legs, long and hairy: abdomen of eight (?) segments. The middle of the head and borders of the abdomen yellowish; the rest of the head, thorax and abdominal blotches tawny.

Genus *Trinoton* Nitzsch. (Plate xiii.) Body large, from 2 to 6 mm. long; head, triangular, with rounding angles, with projecting rounded temples, and convex arcuated occipital margin; antennæ, short and concealed, palpi projecting beyond lateral margins of forehead; eye prominent and emarginated, appearing double; the whole thorax very long, in one species larger than the abdomen; mesothorax separated from metathorax by distinct suture (the diagnostic character of the genus); legs long, strong and haired; first segment of tarsus short, with two narrow and acute lobes, second long with two small lobes near the extremity; abdomen elongate oval, nine segments, the posterior segment being rounded behind in the female and trilobed in the male. Color whitish, with brown or reddish brown blotches and black bands.

Genus *Læmobothrium* Nitzsch. (Plate xiv.) Large species, from 5 to 10 mm. long; body elongate, rather slender; head usually longer than wide, truncate or emarfrom tawny to blackish brown on a whitish ground. Found on birds of prey, and certain water birds.

Genus *Physostomum* Nitzsch. Species large, from 2½ to 5 mm. long; body elongate; head broadly conical, straight or a little concave on the lateral margins, without ocular emarginations; broad and usually truncate or flatly convex in front; temporal corners angulated; the under side of the forehead with two small motile muscular lobes projecting slightly beyond the lateral margins, characteristic marks of the genus; palpi prominent; antennæ very short, always concealed in their furrows; thorax longer than the long head; meso- and metathorax completely fused, the posterior width of the metathorax same as anterior width of first segment of abdomen; legs robust, little colored and with few hairs; first segment of tarsus with a small double lobe; second segment rather short. Abdomen elongate elliptical, ninth segment broad and rounded. Color clear pale brown to yellowish, abdomen with lateral bands. The species are few and have been found as yet exclusively on passerine birds.

Genus *Eureum* Nitzsch. Body large, head and abdomen very wide, and metathorax very short; head without ocular emargination and with temples very much enlarged and rounded; antennæ concealed in their cavities; the palpi never projecting beyond lateral margins of the head; thorax about same length as the head; prothorax concave before and behind; the shorter metathorax of the same form as first segment of abdomen; legs long, second segment of tarsus very long; abdomen with acute posterior angles of segments, and hairy. But two species are known, one found on a swallow and the other on the chimney swift.

Genus *Nitzschia* Denny. Body of medium size, about 2 mm. long; head with small ocular emargination, and a [illegible] [illegible] [illegible] emargination [illegible] the lateral margin [illegible] [illegible] [illegible] the ocular emargination, being about where the [illegible] [illegible] [illegible] the margins of the head; head wider than long, [illegible] rounded and angulated in front and [illegible] [illegible] [illegible] and [illegible] [illegible] in their [illegible] [illegible] [illegible] long and projecting beyond margin of the head [illegible] [illegible] triangular with obtuse angles; [illegible] [illegible] [illegible] [illegible] slightly indicated on the [illegible] [illegible] [illegible] long and [illegible] slightly [illegible]. [illegible] [illegible] segment [illegible] [illegible] with a small acute lobe. Second segment [illegible] [illegible] similar in the sexes. [illegible] [illegible] [illegible] with small lateral bands. [illegible] [illegible] [illegible] [illegible], and lateral bands dark reddish brown. [illegible] the species certainly known; found [illegible] in the [illegible] [illegible].

[illegible] [illegible] [illegible] Plate xii. Body very large, [illegible] mm. long and [illegible] mm. wide; head crescentic, without ocular emargination, with two [illegible]-pointed strongly-[illegible] processes on ventral aspect of hind head projecting backward beyond occipital margin of the head. Antennae [illegible] in ventral [illegible]; the lateral palpi short. Prothorax as large as the head; the metathorax like an abdominal segment; the [illegible] of the front legs bear a long appendage or lobe; abdomen of ten segshort, first two segments truncated, conical, the second rarely with a short appendage, the third usually pedicellated and goblet-shaped, receiving the spherical or ovoid or cylindrical fourth into this open mouth; the fourth is always the largest of the four segments; mesothorax fused with metathorax; legs long, first segment of tarsus very short with a lobe of variable form, second long with a small chitin plate often swollen at its extremity; abdomen differs in the sexes, both as to general form and specially as to the last (ninth) segment; posterior border of ninth segment of female fringed with fine hairs which are not present in male. Color whitish or yellowish with darker markings. This is a very large genus, infesting all kinds of birds.

## TERMINOLOGY.

By means of the following definitions and accompanying figures the student will be enabled to understand, it is hoped, the special descriptive and structural terms used in the synopses, keys and descriptions of Mallophaga. Most of these terms are the English equivalents, as nearly as possible, of the terms used in the French and German monographs. A few of them are here first used.

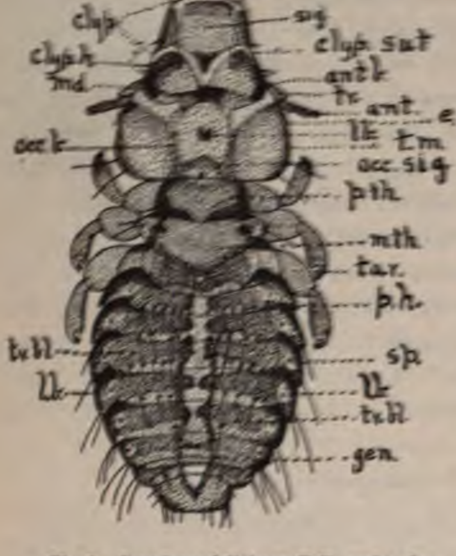


Fig. 1. *Docophorus fuliginosus* Kell., male; *clyp.*, clypeus; *clyp. sut.*, clypeal suture; *clyp. h.*, clypeal hair; *sig.*, signature; *md.*, mandibles; *ant.*, antenna; *tr.*, trabecula; *e.*, eye; *occ. b.*, occipital band; *ant. b.*, antennal band; *lb.*, chitinized part of labium; *occ. sig.*, occipital signature; *pth.*, prothorax; *mth.*, metathorax; *tar.*, tarsus; *p. h.*, "pustulated" hairs; *tr. bl.*, transverse blotch; *l. b.*, lateral band; *sp.*, spiracle; *gen.*, genitalia.

Antennal Appendage (fig. 2). A projecting process on the first or third segments of the antennæ of the males of certain genera. This appendage may be simply a slight projection of one side of the distal extremity of the segment, or may be long and curving, and may arise from the middle of the segment.

Antennal Bands (*ant. b.*, fig. 1). Pale to dark-colored chitinous bands extending along the lateral margins of the forehead, interrupted and divided into two parts when the clypeal suture is distinct, sometimes divided into three parts (*Nirmi nigropicti*).

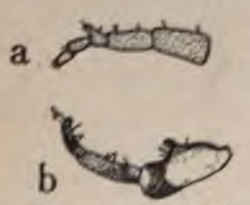


Fig. 2. *a*, antenna of *Lipeurus baculus* ♂; *b*, antenna of *Lipeurus ferox* ♂.

Antennary Furrows (*ant. f.*, fig. 3). The furrows on ventral aspect of head of members of the Liotheidæ in which the antennæ lie, concealed from dorsal view.

Clypeal Hairs (*clyp. h.*, fig. 1). Usually short, fine hairs on the margins, frontal and lateral, of the clypeus.

Clypeus (*clyp.*, fig. 1). That part of the head in front of the clypeal suture; prominent throughout the group.

Clypeal Suture, or, in descriptions of the head, the *suture* (*clyp. sut.*, fig. 1). The distinct or indistinct suture separating the clypeus from the rest of the head; when distinct, appearing as a narrow uncolored line; when indistinct, usually recognizable on the lateral margins of the head by a small emargination.

Forehead. That part of the head in front of the mandibles and antennæ.

Genital Blotch. Abdominal markings on the under side of the last segments of the female; sometimes single and median, sometimes paired and lateral.

Genitalia (*gen.*, fig. 1). The colored chitinized parts of the genitalia, often showing through the surface of the body.

Hind-head. That part of the head behind the mandibles and antennæ.

Inter-coxal Line (*i. c. l.*, fig. 4). A sternal marking consisting of a colored line or narrow band running transversely between two coxæ of the same side.

Lateral Bands (*l. b.*, fig. 1). The dark or transparent lateral margins of the abdomen.

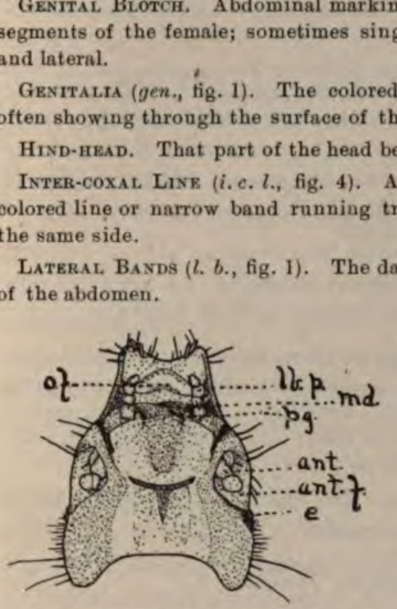


Fig. 3. Under side of head of *Læmobothorium similis* Kell.; *of.*, oral fossa; *lb. p.*, labial palpus; *md.*, mandible; *pg.*, paraglossa; *ant.*, antenna; *ant. f.*, antennary furrow; *e.*, eye.

Labial Palpi (*lb. p.*, fig. 3). The 4-segmented labial palpi, present only among the Liotheidæ; usually projecting laterally beyond the lateral margins of the forehead.

Metathorax (*m. th.*, fig. 1). As the meso- and metathorax are in most genera of the order fused into a single segment; the term metathorax used when no mention is made of the meso-thorax is intended to apply to this compound segment.

Occipital Bands (*occ. b.*, fig. 1). Pale to dark-colored chitinous bands extending from the occipital margin forward to the mandibular rami.

Occipital Margin. The posterior margin of the head.

Ocular Bands. Bands extending from the eyes to the anterior extremities of the occipital bands.

Ocular Blotch. A colored blotch contiguous to the inner margin of the eye.

Ocular Emargination. An emargination of the lateral margin of the head, the eye lying in the emargination though near the posterior end of it.

Ocular Fleck. A small intensely black spot of pigment in the eye.

Oral Fossa (*o. f.*, fig. 3). A furrow lying in front of the mandibles.

Ocular Fringe. A series of closely set small hairs on the posterior half of the inner margin of the ocular emargination and extending to and sometimes on the temporal margin; especially characteristic of *Menopon* and *Colpocephalum*.

lection of any set of specimens in order that he may weigh fairly the probable accuracy of the host determinations and the value of any statements as to relative abundance of the individuals of a species, or of the constant or casual occurrence of any parasite species on the individuals of its host species.

A large number of the specimens upon which the monographs of the order are based were collected from the dried skins of birds in various museums. Piaget has found the museum of Leyden a fertile field for collecting. But it is evident that collecting under such circumstances makes uncertain any generalization regarding the abundance of individuals on the host, and the constancy of occurrence of any certain parasite species on any certain bird species. There is also much likelihood of "straggling" and little opportunity to prove or disprove it. On the other hand, in collecting from the newly-killed birds one can practically determine the total parasitic fauna of any bird specimen; and, where a large series of specimens of one bird species is obtained, definite conclusions as to the constant or casual occurrence of a parasite species upon its host can be attained. The collection of immature specimens is practically restricted to collectors from newly-killed specimens because the tender, unchitinized body of the young insect shrivels soon after death; thus the immature insects are rarely found on dried skins. This may account for the absence of references in the European monographs to the immature stages of any of the described species.

## Methods of Collecting and Preserving.

The methods of collecting are simple. The parasites do not leave the body quickly after the death of the host, so if there is no opportunity to take them from the host in the field immediately after shooting, they may be col-

[illegible] after the dead birds are brought to the laboratory or museum. Most of my collecting has been done in connection with the collection of the birds for museum purposes. The parasites frequent all parts of the body of the host, but after death of the host are especially to be sought about the eyes and base of the bill. Here they seem to congregate, and while sometimes after death of the host many parasites leave the body, others will stop their feeding at the base of the bill and rather than leave the body will fasten themselves by claws or mandibles to the short stiff feathers of this region and die there. The death of the parasites which remain on the body after death of the host takes place in from four or five hours to several days. In most cases all of the parasites are dead at the end of two or three days. It is evident, in view of the fact that after death of host many parasites leave the body, that much care must be taken to prevent the straggling of the parasites from one bird getting upon some other bird which may be conveniently near. In the game-bag each bird should be well wrapped in paper, or, as is common with collectors, placed in a paper cone head downward.

In addition to the examination of newly-killed birds, the examination of freshly-made skins may be made, or in any one vial may be assorted into species putting each species in a vial by itself and giving this vial the same accessions number as the original vial and in addition a sub-number or letter. In my catalogue of accessions there are entered under each accessions number the sub-numbers or letters with specific name of the parasites when determined. By this plan, any specimen of parasite can be traced at any time to the individual bird from which it came, and statistics of abundance on the host, of number of individuals of a single species, or of the constant or casual occurrence of a parasite species on a host species can be compiled. Also, the parasitic faunæ of different specimens of the same bird-species from different localities can be critically compared.

The alcohol modifies the specimens but little; their hard chitin covering prevents appreciable shrinking, and the colors are due chiefly to the excess or scantiness of chitinization in different parts of the body, a coloration not much affected by alcohol. Specimens intended for dissection can be well preserved in soft condition in a five per cent. solution of chloral hydrate.

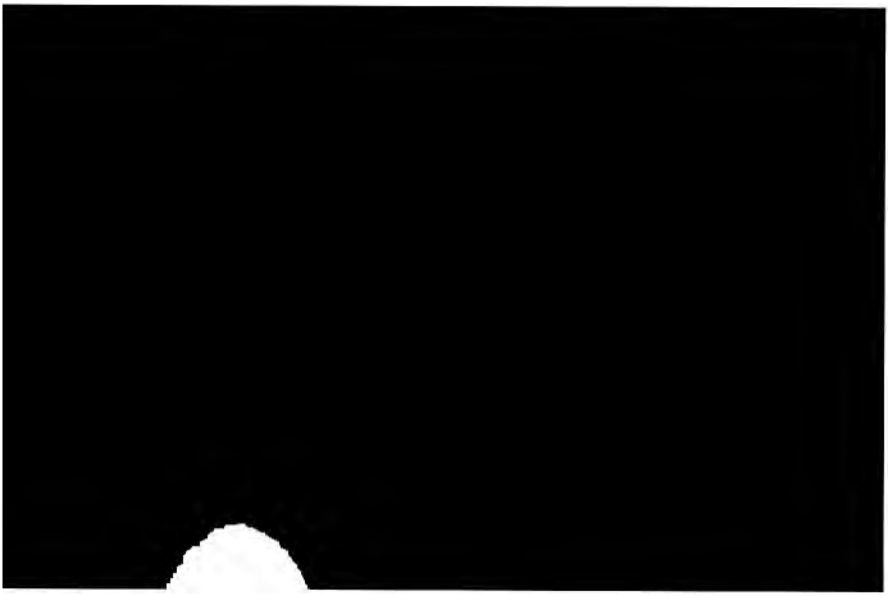
## DESCRIPTIONS OF NEW SPECIES.

**Docophorus calvus** n. sp. (Plate iii, fig. 1.)

A single female, taken on a California Murre, *Uria troile californica* (Bay of Monterey, California).

Description of female. Body, length 1.7 mm., width .8 mm.; short, broad, small, with golden brown markings, darker on margins, almost without hairs.

Head, length .53 mm., width .56 mm., thus being slightly wider than long; conical, with uncolored frontal part of clypeus slightly expanded and feebly emarginate; suture distinct; lateral margin of head in front of suture slightly concave; temporal margins convex with two hairs, and



*drius* very closely resembles the common *melanocephalus* of the Terns.

Description of the male. Body, length 1.62 mm., width .65 mm.; head and thorax smoky golden brown, abdomen dark brown with black markings.

Head, length .60 mm., width .53 mm.; front convex with a narrow uncolored border, and a short hair in each anterior angle; one short, marginal hair in front of the distinct suture, and two behind it; trabeculæ medium; eye inconspicuous, with a short hair; temporal margins with two hairs; occipital margin straight, bare; signature shield-shaped, pale, with acuminate posterior point darker colored; quadrangular space in anterior part of signature slightly darker colored than rest of signature; angulated antennal bands, their continuations in front of the suture as narrow marginal borders, the diverging occipital bands and the marginal temporal borders dark brown; also a narrow occipital border not extending to the sides of the head and interrupted medially.

Prothorax, short, with slightly diverging sides and flatly convex posterior margin; posterior angles with a single hair; color smoky golden brown, with a dark brown lateral border, extending around the posterior angles, and a little way along the posterior margin. Metathorax short, broad, with widely diverging short sides, and broadly parabolic posterior margin thickly set with a series of pustulated hairs. Sternal markings consisting of dark brown intercoxal lines, a pale median prothoracic blotch, and a small, pale, triangular metathoracic blotch. Legs, fuliginous with narrow dark brown to black markings.

Abdomen, broadly ovate, turbinated; segment 2 with specially prominent, acute, projecting, posterior angles; segments 4–8 with one to two hairs in posterior angles;

[illegible]

[illegible] segments [illegible] bars along [illegible] margin [illegible] segment [illegible] segments [illegible] segments [illegible] segment [illegible] diagonally [illegible] and in segment [illegible] a narrow transverse line be-

Description of male. Body, length 2. mm., width .72 mm.; pale golden brown, with characteristic angulated, black, lateral abdominal markings; abdomen Nirmoid, head large and just as broad as long.

Head, length .62 mm., width .61 mm.; broadly conical; clypeus with uncolored, truncated, frontal margin, and rounded angles; a very fine short pair at middle of each rounded anterior angle, and one at the suture; temporal margins with one short prickle and three long hairs; eye with a short hair; trabeculæ broad, acute-angled; antennæ short, thick; signature pale smoky brown, broadly hexagonal; posterior margin slightly rounding; on each side of the signature a similarly colored elongated triangular blotch apex anteriorly; ground color of head pale golden brown with darker mandibles, broad curving antennal bands, narrow temporal margin, and occipital bands convex outwardly; occipital margin straight.

Prothorax, short, broad, a single short hair in posterior angle, and anterior margin deeply emarginated and projecting under the head; broad lateral margins and forward projecting anterior processes dark brown. Metathorax, short, broad, with rounding lateral margins; with a short prickle at rounding anterior angle, a short prickle and long hair in middle of side, and one long and two short hairs at rounding posterior angle; posterior margin slightly convex on abdomen.

Abdomen, long, ovate, with obtuse posterior angles of segments projecting along lateral margin, the angles of segments 1–6 bearing a single hair, 7–8 with two hairs; first segment with brown triangular blotch in anterior angles, segments 2–7 with brown transverse blotches covering almost entire segment; along lateral margins on each segment a sharp blackish angulated line extending forward into preceding segment; inside of this broken marginal line the stigmatal series, and still inside a faint continuous uncolored line; transverse blotch on segment 8 curving, and the lateral line narrow and sinuous; segment 9 but weakly colored; the genitalia extending forward into the eighth segment, and with distinct small claws at posterior end.

The female specimens were so distorted in preparation as to preclude any careful description. The ninth segment is small but distinct, feebly and broadly emarginated, and has two lateral triangular pale brown blotches. The general abdominal markings similar to male, the characteristic angulated black lateral lines being present.

**Docophorus acutipectus** n. sp. (Plate iii, fig. 4.)

A single female taken on the Rhinoceros Auklet, *Ceratorhina monocerata* (Bay of Monterey, Cal.) This species resembles *D. celedoxus* Nitzsch, taken on *Alca torda*, *Uria troile* and *Fratercula arctica*, but differs in the absence of sternal markings, the almost failing emargination of the clypeus, the character of the genital blotch of the female, and in the larger size.

Description of female. Body, length 1.94 mm., width .7 mm.; golden brown with darker markings, middle space in abdomen whitish.

Head length .56 mm., width .56 mm.; general markings and shape of *celedoxus;* front of clypeus with very faint emargination, one short marginal hair and another just in front of suture; trabeculæ large, obtuse, reaching to middle of second segment of antenna; antennæ with short thick first segment, second segment longest, bearing a short dorsal hair, third and fourth short, equal, fifth longer; temporal margin with two hairs, eye with a short hair, occipital border straight; signature pale smoky brown, long, with posterior acuminate point, darker colored; suture distinct; dark brown antennal bands, continuing in front of suture, behind it angularly curving; occipital bands diverging, and separated from antennal bands by an uncolored line.

Prothorax short with lateral margins obtusely angulated and bearing one hair in angle; broad lateral colored border, anterior border colored, median uncolored space. Metathorax obtusely angled laterally, long and acutely angled on abdomen, three hairs in margin behind lateral angle, broad lateral borders colored. No sternal markings. Legs concolorous with body.

Abdomen elongate ovate; first segment wholly colored except for distinct narrow median uncolored line not reaching quite to posterior border of segment; segments 2–7 with lateral blotches, on segments 2–5 pointed within, on segments 6–7 blunt within; each blotch with stigmatal spot and several wholly or partly enclosed small circular clear spots along posterior margin; segment 8 longer and wholly colored, segment 9 short with two lateral flecks; genital blotch of under side with frontal transverse bar, and extending backward two pointed elongate triangular spaces, lateral ends of the transverse bar diagonally truncate.

**Docophorus quadraticeps** n. sp. (Plate iii, fig. 5.)

A male and a female taken from an American Coot, *Fulica americana* (Monterey, California). This species closely resembles *kansensis*, taken from an American Eared Grebe, *Colymbus nigricollis californicus* (Lawrence, Kansas). It differs from it by its larger size, the more rotund abdomen, in the distinctly long acuminate signature, and less markedly in the genital blotch.

Description of female. Body, length 1.87 mm., width .87 mm.; short golden brown with narrow dark margins of thorax and anterior half of abdomen, and short triangular abdominal blotches with few large pustulations.

Head, length .6 mm., width .6 mm.; broadly conical, forehead especially broad; front truncate with a hair on dorsal surface in rounded anterior angle, projecting forward behind the hair two very short ones (not marginal, and showing through from underside), and behind them a very long hair; at suture a short marginal hair, and behind the suture two curving hairs on dorsal surface near the margin and projecting beyond the margin; trabeculæ large, broad and colored at base with rapidly tapering uncolored tip; antennæ, weakly colored, first segment thick, second segment slender as long as first segment, third, fourth and fifth short and about equal; temporal angles with three long pustulated hairs, also a marginal hair just behind the eye and a long one in the eye; occipital margin slightly convex in the middle and slightly concave each side of the middle; signature pale, broad, truncate anteriorly and with long, acuminate, darker colored tip projecting beyond the mandibles; antennal bands pale, interrupted by the distinct clypeal sutures, and coalescing with the much darker, conspicuous, widely diverging occipital bands; temporal margins narrowly edged with black.

Prothorax short with rounding angles, posterior margin lateral, brown, triangular blotch, with an outer, marginal, narrow, blackish line contiguous to the anterior margin of the segments, but leaving an uncolored space about one-third the length of the segment between the hind margin of blotch and posterior margin of segment; each segment with a single transverse series of long hairs pustulated along the posterior margin of the triangular markings, but not pustulated in the median, uncolored portion of the segment; a conspicuous, clear, stigmatal spot in each blotch; triangle of first segment extending furthest inwards (nearly to median line), and shorter on each succeeding segment; eighth segment wholly colored; ninth segment uncolored, short and emarginated; a large, broadly crescentic, genital blotch with a median, angulated projection in posterior concave border on ventral face of segments 6–7.

Male, length 1.5 mm., width .4 mm.; head, length .53 mm., width .5 mm.; abdomen short, broadly ovate, with triangular blotches prolonged inwardly; ninth segment flatly rounded behind with a few rather long hairs.

**Docophorus montereyi** n. sp. (Plate iii, fig. 6.)

Abundant on the Ancient, Marbled and Aleutian Murrelets, *Synthliborhampus antiquus*, *Brachyrhampus marmoratus* and *Ptychorhampus aleuticus* (Bay of Monterey, California). Specimens were taken from forty-six individuals out of fifty-five birds of these species shot.

Description of male. Body, length 1.56 mm., width .53 mm.; head large, pale golden brown, abdomen dark, thorax and abdomen with black lateral border.

Head, length .47 mm., width .43 mm.; uncolored front of clypeus very slightly expanded, rounded with a single marginal hair on the side in front of the suture; trabeculæ large reaching almost to the middle of the second antennal segment; antennæ with first segment thick and about as long as second, third and fourth very short, equal, fifth longer than third or fourth; eye with short curving hair; temporal margins with two hairs; occipital margin straight, even slightly convex noticeable at least medially; color pale smoky brown; signature shield shaped with produced acuminate posterior angle not reaching the mandibles, darker colored; antennal bands dark brown, distinct, posterior ends turning diagonally inwards, anterior ends where interrupted by the suture turning in toward the base of the point of the signature, and tapering to an acuminate point; occipital bands dark brown, narrow, uniform, widely diverging, and separated from the antennal bands by a pale diagonal space; region immediately contiguous to the eye dark brown.

Prothorax short, broad, sides diverging, a single long hair in posterior angles; hexagonal, the middle third of the posterior margin making a very obtuse but distinct angle with the lateral thirds; a broad, uniform, dark brown to black border on the lateral margins and lateral thirds of the anterior and posterior margins. Metathorax with sides rapidly diverging; posterior margin with rounding angle on the abdomen, and a series of about fourteen pustulated hairs ranged along its entire length from lateral angle of one side to lateral angle of the other side; lateral margins these blotches and lines black along lateral margin of body forming broad, black, lateral, abdominal bands; the blotches and lines separated medially by a pale, almost uncolored space on segments 2–5; on segments 6–7 and on posterior half of segment 5 the blotches and lines coalesce on the median line; several pustulated hairs ranged along posterior margins of blotches on segments 2–6; last segment flatly rounded posteriorly with several longish hairs, a curving, transverse, medial blotch, and regions of the anterior angles uncolored.

Female, with transverse blotches of segments 2–7 of abdomen very short, beginning with anterior segments successively acute, diagonally truncate, and truncate on inner ends, the usually three pustulated hairs conspicuous; large medial space of abdomen whitish; last segment fuscous, with five longish hairs in two groups, one of two and one of three, on each side; measurements, length 1.75 mm., width .7 mm.; head, length .53 mm., width .51 mm.

**Docophorus occidentalis** n. sp. (Plate iii, fig. 7.)

An abundant species on the Pacific Coast varieties of the Fulmar, *Fulmarus glacialis pacificus* and *F. g. rodgersii;* found on twenty-nine of thirty of these Fulmars shot on the Bay of Monterey, California. Two specimens, probably stragglers, taken on two Surf Scoters, *Oidemia perspicillata* (Bay of Monterey).

Description of the male. Body, length 1.56 mm., width .7 mm.; short, broad, strongly-colored, with black abdominal bands and triangular, lateral, abdominal blotches.

Head, length .53 mm., width .53 mm.; conical, with truncate or weakly convex front; three very small marginal hairs, one of which is slightly in front of suture; trabeculæ reaching slightly beyond base of the second antennal segment; antennæ colored except at sutures, second segment longest, third, fourth and fifth segments about equal; temporal angles with two hairs; eyes with a short spine; occipital margin straight or slightly convex; signature broadly shield-shaped, constricted near the front, anterior margin truncate or slightly emarginated, posterior margin with a darker colored obtuse angle; angulated antennal bands dark colored and specially distinct; occipital bands distinct, widely diverging, and interrupted by a diagonally transverse uncolored line; temples dark brown, narrowly margined with black; occipital margin between bases of occipital bands with border of same width and color as occipital bands, paler in the middle.

Prothorax short, broad with slightly diverging sides and rounded posterior angles, with one hair; with marginal lateral bands bending inwards along posterior margin. Metathorax pentagonal, angled on abdomen, with a series of seven pustulated hairs ranged along latero-posterior margins beginning at lateral angles; last hair of each series removed from others and near the posterior angle; segment mostly brown, with a dark lateral blotch in each lateral angle extending indistinctly along latero-anterior sides. Legs light brown, with dark brown markings. Sternal markings consisting of a short, broad, transverse line in front of the mesocoxæ, terminating inwardly in an expanded circular spot; a distinct, narrow, transverse, intercoxal line between meso- and metacoxæ, bending backward and margining narrowly the coxal cavity, and four small median spots, the hindmost of which is the largest.

Abdomen short, broadly ovate, segments 1–7 with elongate, narrow, brown triangles, with acute apex inwardly; each one of segments 2–6 with three pustulated hairs, one near the lateral margin of the triangle and two near the apex, all along the posterior margin of the triangle; segment 1 with one pustulated hair near the middle, and segment 7 without hairs; segment 8 with narrow curving, transversal, nearly continuous brown band, and segment 9 wholly colored but paler; outer margin of each triangle broadly black, producing black lateral abdominal bands; posterior margin of segment 9 flatly rounded, with about ten longish hairs; segments 3–7 with one to three longish hairs in posterior angles; genitalia extending forward to third segment, and posterior pincer-like portion very strong.

Female. Body, length 1.8 mm., width .78 mm.; head, length .53 mm., width .53 mm.; pustulated hairs of metathorax at subequal distances apart; triangular blotches of abdomen not projecting so far inwardly, and with but two pustulated hairs; segment 8 wholly colored; segment 9 very small, uncolored, with two small lateral blotches, posterior end truncate, and with one short spine at each posterior angle; genital blotch on ventral face of segments 6–7, transverse anteriorly, with two posteriorly projecting pointed processes.

**Docophorus kansensis** n. sp. (Plate iii, fig. 8.)

A single female specimen taken from an American Eared Grebe, *Colymbus nigricollis californicus* (Lawrence, Kansas). The new form somewhat resembles *colymbinus* (Piaget, Les Pediculines, 1880, p. 117, pl. x, fig. 5, from *Colymbus septentrionalis*), especially in the shape and markings of the head; but the well-defined and characteristic abdominal markings are very different from the abdominal markings of *colymbinus*.

Description of female. Body, length 1.6 mm., width .64 mm.; pale golden brown, with darker, narrow, thoracic borders and short, lateral, triangular, abdominal blotches bearing a few, long, pustulated hairs.

Head, length .47 mm., width .44 mm.; broadly conical, front broad, slightly convex with a shallow median emargination; a hair arising from the dorsal surface near the obtuse anterior angle projects forward beyond the margin; behind this two short hairs (not marginal and showing through as in n. sp. a) and behind these a rather long hair; two short marginal hairs; trabeculæ long and rather slender, acutely-tipped; antennæ long; temporal angles with three hairs, also one hair just behind the eye, and one in anterior angle of eye; occipital border slightly convex; forehead much paler colored than hind head; signature short with slightly concave anterior margin and obtusely angled hinder margin; antennal and internal bands pale, temples and widely separated occipital bands darker.

Prothorax subquadrangular; rounded posterior angles with one hair; posterior border straight; distinct, regular, colored lateral borders. Metathorax pentagonal; with two non-pustulated hairs in lateral angle and five pustulated hairs ranged along each latero-posterior margin; uniform lateral colored border. Legs pale colored except tarsi and claws.

Abdomen, elongate ovate, without angulated lateral projections, with a few pustulated hairs on surface, and one or two rather longish hairs in posterior angles; segments 1–7 with lateral trangular blotch bearing three or four pustulated longish hairs ranged along posterior border of blotch; an uncolored stigmatal spot in each blotch; the lateral margins of segments 1 and 2 (less distinctly in 2) bordered with dark brown like the thoracic segments; segment 8 with transverse blotch extending entirely across the segment; and segment 9 uncolored or faintly colored, with slight emargination and only a few very short hairs.

**Docophorus atricolor** n. sp. (Plate iii, fig. 9.)

Not uncommon on the Ancient and Marbled Murrelets, *Synthliborhampus antiquus and Brachyrhampus marmoratus* (Bay of Monterey, California). This species is closely related to *colymbinus*.

Description of male. Body, length 1.75 mm., width .71 mm.; rather elongate, Nirmoid in shape, darkly colored all over with wide, black, lateral, abdominal bands.

Head, length .53 mm., width .6 mm.; slightly broader than long, front broad, with shallow rounding emargination, uncolored portion of clypeus slightly expanded, anterior angles rounding; one very short fine marginal hair at indistinct suture; trabeculæ small; antennæ short and slender; temporal margins with two long hairs; eyes flat with a spine; occipital margin concave; clypeal signature broad anteriorly, with truncate front margin, tapering slowly posteriorly to truncate, posterior margin reaching the mandibles; antennal bands darkly brown, right-angled, with posterior ends extending transversely inwards to mandibles; occipital bands distinct, slightly diverging and separated from forehead by a transverse, weakly colored, linear space behind antennal bands; temporal regions brown with margins darker.

Prothorax, small with anterior margin emarginated and projecting under the head; lateral and anterior margins distinctly and evenly bordered with dark brown to black, rest of segment brown; a short spine on lateral margin, and at rounded posterior angle a single hair. Metathorax short, broad, posterior margin flatly convex, angles rounded; a long hair and short spine in an uncolored space in front of middle of lateral margin, and three long hairs in posterior angle; segment wholly colored with darker, small, lateral, marginal blotch, in which is located the clear space containing hair and spine. Legs brown with darker markings.

Abdomen elongate, elliptical, segments short of about equal length; each segment with two weak median hairs on dorsal surface; whole colored dark smoky brown except tip of ninth segment; broad black lateral bands, connected on each segment by a narrow transverse black bar across middle of segment; on first segment this bar broader, covering nearly whole surface of segment, and with a narrow uncolored median line; ninth segment truncate behind with flatly rounded posterior angles; a series of short pustulated hairs along posterior margin; genitalia in segments 8 and 9, side pieces with a distinct toothed posterior claw.

Female, same size; not so dark; ninth segment emarginated for one-half its length, the points being obtusely angled, and with one very short hair each.

**Docophorus insolitus** n. sp. (Plate iv, fig. 5.)

A few specimens, male and female, taken from an Aleutian Murrelet, *Ptychorhampus aleuticus* (Bay of Monterey, California). This species was not found on other of the numerous individuals of the same bird species taken at Monterey.

Description of female. Body, length 1.65 mm., width .50 mm.; elongate, narrow, Nirmoid in general appearance, with long trabeculæ and distinct clypeal suture; color of head and thorax yellowish brown, abdomen whitish, with strongly marked dark brown bands of the head, borders of thorax, and blackish abdominal lateral bands, and brown transverse blotches.

Head, length .5 mm., width .4 mm.; large in comparison with total size of body, the head being nearly one-third of the total body length, elongate conical; that part of the head in front of the mandibles specially long; front broad, convex, with the margin finely crenulate; three small lateral marginal hairs on forehead; trabeculæ large, blunt; eye with a short hair; temporal angles rounded, with two rather short curving hairs; occipital margin straight; bands of the head, viz., broad antennal, diverging occipital, distinct ocular reaching the tips of the occipital, and narrowly marginal, dark brown and well marked; pale brown signature large, with dark brown posterior angle not reaching mandibles and rather blunt.

Prothorax short, broad, with rounded angles and convex posterior margin; one hair in posterior angles; distinct dark brown lateral and anterior borders, also extending inwards from the posterior angles along the posterior margin, but not meeting; median space almost uncolored. Metathorax pentagonal, with rounding lateral angles and six hairs on each latero-posterior margin; broad lateral dark brown border, broadest in lateral angles. Legs concolorous, with pale brown tinge of body, tarsal claws darker.

Abdomen elongate, narrow, posterior angles of segment 2 produced, acuminate; lateral margins with two longish hairs, a few longish hairs on dorsal aspect; lateral bands semitranslucent smoky brown, composed of a series of slightly diagonal, narrow, marginal blotches, one on each segment, each blotch widest anteriorly, tapering posteriorly and not quite reaching the posterior angle of the segment; segments 1–7 with lateral transverse blotches, those on segment 1 meeting on the median line; large median region of abdomen whitish; segment 8 wholly colored; segment 9 small, uncolored, with very slight angular emargination; genital blotch a narrow, curving, transverse band across segment 6.

Male. Smaller, length 1.34 mm., width .38 mm.; head, length .47 mm., width .37 mm.; metathorax almost wholly fuscous; the lateral transverse blotches of abdomen longer, those on segments 6–7 almost, if not quite, meeting on median line; last segment broadly rounded with several hairs; genitalia pincer-like.

**Docophorus icterodes** Nitzsch. (Plate iv, fig. 1.)

Germar's Mag. Entomol., 1818, vol. iii, p. 290.

*Pediculus dentatus* Scopoli, Entomol. Carniol., 1763, p. 383.

*Docophorus icterodes* Nitzsch, Burmeister, Handbuch d. Entomologie, 1832, vol. ii, p. 424; Gurlt. Mag. f. ges. Thierheilk., 1842, vol. viii, p. 415; Denny, Monograph. Anoplur. Brit., 1842, p. 101, pl. v, fig. 11; Grube, v. Middendorff's sibir. Reise., 1851, vol. ii, part 1, p. 468; Giebel, Insecta Epizoa, 1874, p. 115, pl. x, fig. 8; Piaget, Les Pediculines, 1880, p. 114, pl. x, fig. 1.

Specimens of this common parasite of ducks taken on the Surf Scoter, *Oidemia perspicillata*, the Ruddy Duck, *Erismatura rubida*, the Red-breasted Merganser, *Merganser serrator* (Bay of Monterey, California); and from the Mallard, *Anas boscas*, the Greenwinged Teal, *Anas carolinensis*, the Redhead, *Aythya americana*, the Lesser Scaup, *Aythya affinis*, and the Pintail, *Dafila acuta* (Lawrence, Kansas). Piaget, Giebel and Denny list fully a dozen species of ducks on which *icterodes* has been found.

Giebel has described (Insecta Epizoa) three other species of *Docophorus* (*adustus*, p. 113, *brevimaculatus*, p. 114, and *brunneiceps*, p. 114) found on ducks, and Rudow ored signature, and on each side of it the triangularly-headed anterior projection of the antennal band.

**Docophorus pertusus** Nitzsch. (Plate iv, figs. 2 and 3.)

Germar's Mag. Entomol., 1818, vol. iii, p. 290.

*Docophorus pertusus* Nitzsch, Burmeister, Handbuch d. Entomologie, 1832, vol. ii, p. 426; Giebel, Insecta Epizoa, 1874, p. 108, pl. xi, figs. 3, 12; Piaget, Les Pediculines, 1880, p. 89.

Males, females, and young from eight out of eleven specimens of American Coot, *Fulica americana* (Monterey, California), and from one out of three specimens of same bird species taken at Lawrence, Kansas. A single specimen was taken from a Ruddy Duck, *Erismatura rubida* (Monterey, California). The Ruddy Ducks and Coots are such constant associates that it is not surprising to find this Coot parasite occasionally on this species of duck. Also a single male was taken from an American Eared Grebe, *Colymbus nigricollis californicus* (Bay of Monterey, California). The characteristic forcipated appearance of the clypeus easily distinguishes the species; in some specimens the "pincers" will be found closed, so that the deep frontal emargination is quite enclosed, while in others the "pincers" will be open. My specimens do not agree with Giebel's figures and Piaget's description as to length of signature; in my specimens the acuminate posterior point extends quite to the mandibles. I figure a female, and an immature specimen. The young stage is interesting, as it shows no evidence of the pincer-like condition of the clypeus, and the clypeal signature is arrested far in front of the mandibles. The measurements of the specimens figured are: Female, body, length 2. mm., width .92 mm.; head, length .6 mm., width .6 mm. Immature, body, length 1.7 mm., width .84 mm.; head, length .52 mm., width .5 mm. Nitzsch's specimens were found on *Fulica atra*.

**Docophorus lari** Denny. (Plate iv, fig. 4.)

Monograph Anoplurorum Britanniæ, 1842, p. 89, pl. v, fig. 9.

*Pediculus lari* Fabricius, Fauna Groenlandica, 1780, p. 218.

*Philopterus lari* Fabr., Walckenær, Hist. Nat. Ins. Apt., 1844, vol. iii, p. 337.

*Docophorus gonothorax* Giebel, Zeitschr. f. ges. Naturwiss., 1871, vol. xxxvii, p. 450; Giebel, Insecta Epizoa, 1874, p. 111.

*Docophorus congener* Giebel, Insecta Epizoa, 1874, p. 111.

*Docophorus lari* Denny, Piaget, Les Pediculines, 1880, p. 111, pl. ix, fig. 7.

Many specimens of this common parasite of the gulls on *Larus argentatus smithsonianus*, *canus*, *occidentalis*, *brachyrhynchus*, *glaucescens*, *heermanni*, *vegæ*, *delewarensis*, *glaucus* and *Rissa tridactyla pollicaris* (Bay of Monterey, Cal.), and from *Larus delewarensis* (Lawrence, Kansas). In all, I have examined eighty-seven specimens of gulls of the various species mentioned, and have collected this parasite on seventy-eight of them. Piaget and others have found this parasite on *Larus canus*, *marinus*, *fuscus*, *glaucus*, *argentatus*, *ridibundus*, *atricilla*, *islandicus*, *leucophæus*, *cyanorhynchus*, *Pagophila eburnea*, *Rissa tridactyla*, *Sulla bassana*, and *Lestris parasiticus*. I have found males, females and young of this parasite on *Colymbus nigricollis californicus* and *Urinator lumme;* these can hardly be stragglers.

Piaget has named and briefly described three varieties of this species, there being apparent a considerable variation in size, in shape of the clypeus and character of the male genitalia. The careful examination of a large number of specimens from different species of gulls is necessary for an understanding of the condition of the species. I hope to have opportunity to make such a study soon.

The species is easily recognized by the strong markings, broad truncate clypeus and large acuminate signature. The female specimen figured measured as follows: body, length 2. mm., width .93 mm.; head, length .62 mm., width .63 mm.

Despite the smaller size I do not understand, from the description, how Picaglia's *D. larinus* (Atti d. Soc. Ital. d. Sci. Nat., 1885, vol. xxviii) differs specifically from *lari*.

**Docophorus melanocephalus** Burmeister. (Plate iv, fig. 6.)

Burmeister, Handbook d. Entomologie, 1832, vol. ii, p. 426.

*Docophorus laricola* Nitzsch. (*in pars*) Zeitschr. f. ges. Naturwiss. (ed. Giebel) 1866, vol. xxviii, p. 363.

*Docophorus caspicus* Nitzsch. Zeitschr. f. ges. Naturwiss. (ed. Giebel) 1866, vol. xxviii, p. 361, fig. 87.

*Docophorus melanocephalus* Burm. Giebel, Insecta Epizoa, 1874, p. 110, Pl. xi, fig. 8; Piaget, Les Pediculines, p. 109, pl. ix, fig. 5.

Many specimens taken from the Royal Tern, *Sterna maxima*.

This is the most abundant parasite of this Tern (Bay of Monterey, California). I found it on every one of fourteen specimens shot. The European authors record its occurrence on *Sterna caspia*, *cantiaca*, and on *Larus ridibunda* and *cirrocephalus* (localities?). Giebel describes also as a distinct species *lobaticeps* (Insecta Epizoa, p. 109), a closely related, if not identical, form taken on *Sterna hirundo* and *Sterna fissipes*. Piaget believes *lobaticeps* to be identical with *melanocephalus*.

The distinguishing characters of *melanocephalus* are its general dark color, its especially dark colored head, prominent signature with long acuminate point reaching the mandibles, slightly convex clypeal front, and the presence of a small spine and a short hair in the eye. The measurements of the female specimen figured are: Length 2.1 mm., width .9 mm.; head, length .65 mm., width .65 mm.

**Nirmus præstans** n. sp. (Plate v, figs. 1 and 2.)

Taken on the Royal Tern, *Sterna maxima* (Bay of Monterey, California). But two specimens, both males, of this new *Nirmus* were taken, one from each of two birds. The new form belongs to the group *nigropicti*.

Body, length 3.25 mm., width .5; with marginal markings of black, and abdominal blotches of chestnut brown.

Head, length .56 mm., width .5 mm.; broadly conical, widest at posterior angles, with temporal margins and margins of forehead in nearly straight diagonal lines; clypeus truncate in front (even slightly concave), with three lateral short hairs; signature with broad anterior margin colored (brown); a rather broad lateral black line interrupted posteriorly by the suture, but reappearing behind the suture as a black blotch; antennal bands black, outer ends curving forward; trabeculæ distinct, as long as first antennal segment; antennæ with second segment longest, fifth longer than third or fourth which are equal, uncolored, except the fifth segment, which is light brown with distinct short hairs on tip; eyes with a bristle; temporal margins narrowly bordered with black and with one long hair; occipital angles rounded, posterior border doubly emarginated; occipital signature black and labium brown, visible on under side; mandibular rami strongly colored.

markings consisting of broad intercoxal lines, and a triangular median blotch on metathorax. Legs mostly uncolored, with femur semiannulated with dark brown at basal and distal extremities; tibiæ annulated at distal end; tarsus light brown; claws uncolored.

Abdomen, elongate ovate; posterior angles of segments with few hairs; surface glabrous, first segment without transparent lateral margin, with circular black spot in anterior angle; segments 2–6 with transparent lateral margin, narrower posteriorly; in each anterior angle a black, linear, obliquely directed blotch produced anteriorly across the suture and into the preceding segment; on segment 7 this blotch very faint or obsolete; at the posterior angle a small distinct blotch; on the eighth segment a small marginal blotch, and on the ninth a transversal, curving, brown line; on the dorsal surface a small, short, curving, median, transversal brown line on the second segment, and a similar slightly larger one on the third segment; on segments 3–6 the broad transversal blotches of the ventral surface show through, as also do the chitinized parts of the genitalia; on the ventral surface there are median transversal brown markings as follows: on the first segment a small wide triangle, on the second segment a semiellipse with convex side forward, on segments 3–6 broad transverse blotches largest on segments 4–5; genitalia showing distinctly; one or two hairs at posterior angles of segments 1–7; segment 8 with a strong, long, hair and a shorter one on lateral margin; segment 9 with strong hairs arising from dorsal and ventral surfaces of the rounded posterior margin, in all about ten.

**Nirmus hebes** n. sp. (Plate v, fig. 3.)

A single poorly-preserved specimen from a Royal Tern, *Sterna maxima* (Bay of Monterey, California).

Description. Body, length 1.72 mm., width .5 mm.; strongly marked, abdomen with large, lateral, transverse blotches and an uncolored longitudinal median line.

Head, length .47 mm., width .35 mm.; elongate conical, front truncate, bare (?); trabeculæ small but distinct; temporal margins subparallel, with one hair near posterior angle; antennal bands distinct, dark brown, bending inwards at the suture, and with posterior extremity expanded; temporal margins narrowly edged with dark brown; occipital bands indistinct, diverging, more strongly colored at base.

Prothorax with rounded angles, bare (?); posterior margin flatly convex, with colored lateral border. Metathorax with rounded anterior angles, diverging sides and obtuse posterior angles; angulated on abdomen; two or more hairs in posterior angles; lateral borders colored. Legs concolorous with body, with darker narrow margins. Sternal markings consisting of two pairs of intercoxal lines.

Abdomen elongate elliptical; posterior angles of posterior segments with short hairs; each of segments 2–7 with a marginal black blotch, widest anteriorly and projecting inward along the anterior margin of segment, but paling to brown; this projection stops at a median, longitudinal, uncolored line, turns posteriorly to the posterior margin of the segment and runs along the segment outwardly for a short distance; that part of the lateral portion of the segment not colored by this black and dark brown curving blotch is golden brown; segment 8 wholly colored with narrow, black, lateral margin; segment 9 uncolored, with two small, brown blotches; posterior margin feebly emarginate.

**Nirmus farallonii** n. sp. (Plate v, fig. 4.)

A single female specimen taken from a Farallone Cormorant *Phalacrocorax dilophus albociliatus* (Bay of Monterey, Cal.) An immature specimen taken from a Western Grebe, *Colymbus septentrionalis* (Bay of Monterey, Cal.) is also probably of this species. It may be a straggler. In general marking and outline this new species resembles *Nirmus dispar* Piaget, taken by the namer on a *Carbo sulcirostris* from a skin in the Leyden Museum. *Dispar* is a much smaller species, and lacks the characteristic median abdominal blotches of *farallonii*.

Female. Body, length 2.66 mm., width .84; ground color pale clear brown; strongly and extensively marked with dark brown.

Head, length .6 mm., width .53 mm.; conical, narrow in front and rounding; five marginal hairs, a long one on dorsal surface between the front two and two shorter ones on dorsal surface near the fourth marginal; trabeculæ small and nearly obtuse; temporal margins rounding and with one long hair and several short prickles; occipital margin slightly concave; eyes prominent, with a very short prickle; antennæ short, second segment longest, third and fourth about equal, fifth longer, concolorous with pale ground color of head; clypeal signature distinct, short pentagonal, with hinder margins and posterior angle rounded; whole head, except small parts of clypeus, pale brown; antennal bands broad, distinct, bending in at suture; small black ocular flecks, and converging occipital bands.

Prothorax shorter than broad, quadrangular with rounding angles; one long hair and one short thorny hair at posterior angle; color brown, with darker lateral bands which expand into triangular dark brown blotches in posterior angles. Metathorax broader than long, quadrangular with lateral margins diverging slightly, and anterior angles distinctly expanding and tubercular in front of a constriction; posterior margin straight; posterior angles with one long and one short hair in point of angle, and near them five long hairs set in an elliptical clear space; brown, palest in center, lateral bands very dark in posterior two-thirds, and bending in along anterior margin. Legs colored.

Abdomen elongate elliptical, with posterior angles projecting, and two or three rather long hairs in each angle; a few long hairs on dorsal surface; segment 1 all brown, others with strong, quadrangular, lateral, brown blotches, black on outer margin, and with uncolored stigmatal spots and a median quadrangular light brown blotch; posterior angles uncolored; segments 8–9 undivided, but with distinct blotches and no median blotches; segment 9 rounding, hardly if at all emarginated, and with only a few short hairs.

**Nirmus orarius** n. sp. (Plate v, fig. 5.)

A single specimen from a Golden Plover, *Charadrius dominicus* (Lawrence, Kansas). This form is a member of the group *obscuro-suturati*, and resembles somewhat my species *bæphilus* from a Killdeer Plover, *Ægialitis vociferus;* the body, however, is shorter and not parallel-sided, though the form is still a slender, graceful one.

Female. Body, length 1.84 mm., width .4 mm.; pale with narrow distinct marginal markings.

Head, length .5 mm., width .28 mm.; head elongate conical, with expanded uncolored part of clypeus in front not angulated as in *bæphilus*, but rounding; three clypeal hairs and one on dorsal surface in front of the trabecula projecting over the margin; trabeculæ small, clear, but distinct; temporal margins weakly convex with two long hairs; occipital margin faintly concave; eyes flat with a long hair; antennæ uncolored, short; clypeal signature uncolored; mandibles and labium brown, a narrow lateral brown margin along forehead interrupted in front of antennæ and at suture and along temples.

Prothorax markedly narrower than head; quadrangular, with sides converging slightly toward front; one hair in posterior angle; with brown marginal band distinct along posterior margin. Metathorax but little longer than prothorax, wider, with rapidly diverging lateral margins; posterior margin angulated; four long hairs in posterior angles, grouped in pairs, one pair being a short distance inward on posterior margin; an interrupted, lateral, brown band and a long, triangular, brown blotch projecting inwards from middle of lateral margin. Legs uncolored with weakly colored tarsi.

Abdomen elongate, with convex sides, not parallel; segments of about equal length; segment 9 short and with weak, rounding emargination on posterior margin; a few scattered weak hairs on surface, and segments 5–8 with one or two weak hairs in posterior angles; a narrow, lateral band emphatic in anterior part of each segment and margined outwardly by a narrow clear space; segments 1–6 with large, median, pale brown transverse blotch.

**Nirmus giganticola** n. sp. (Plate v, fig. 6.)

This well-marked *Nirmus* of the group *nigropicti* was taken from the Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). It was found on both of two birds of this species shot. I have not found it on any other bird-species.

Body, length 3.5 mm., width .87 mm.; white with a few definitely arranged black and brown spots; of about the average size and usual shape of the *Nirmi nigropicti*;

body with a few hairs on margins, general surface glabrous.

Description of male. Head, length .75 mm., width .62 mm.; conical, front produced and narrowly rounded, almost angulated; sides of forehead with five hairs, and one short one between the first two which rises on upper surface of clypeus at some distance from the margin; between second and third marginal hairs a short hair rising from surface of head so far inward that its tip does not project over the margin; temporal margins rounding, with few short hairs; occipital margin slightly and broadly concave; trabeculæ wanting; eyes distinct; antennæ with first and second joints longest, each as long as third and fourth, fifth longer than fourth, uncolored; clypeus uncolored; margins of forehead with a short, interrupted, dark brown line; an irregularly shaped dark brown orbital blotch; a small occipital signature; mandibles chestnut brown.

Prothorax rectangular, angles obtuse, glabrous, uncolored, with broad transparent margin. Metathorax trapezoidal, widest at posterior angles; lateral margins slightly concave, deepest before the middle; posterior margin weakly concave; a slender hair at each posterior angle, hairs, eighth segment with two hairs at each anterior and posterior angle; ninth segment feebly angularly emarginated with one short stiff hair on each side of the emargination; lateral margins of abdomen transparent, containing entering whitish appendages of clear chitin, and on segments 2–7 a small distinct black blotch near the anterior angle of each segment; seventh segment also with a slightly curving, elongate, black fleck in the posterior angle; eighth segment marked like the seventh except that the posterior blotch is more narrowly linear; segment 9 with a narrow marginal blotch on each side.

Female generally similar to male; abdomen with one hair on posterior angle of first segment, two hairs on segments 2–4, three hairs on segments 5–7; segment 9 more acute than in male and two-pointed; segment 8 with linear blotch extending along whole length of margin; inside of lower end of this blotch and of marginal blotch of ninth segment a curving, linear, brown blotch; opening of vulva with nine stiff hairs on each margin.

This member of the *Nirmi nigropicti* differs markedly by the produced and narrowly rounded clypeus, the long metathorax with acuminate posterior margin, and the entire absence in both sexes of transverse blotches or lines on the abdomen from such forms as *punctatus*, *selliger*, and *lineolatus*, which in general appearance are somewhat similar to this new form.

**Nirmus bœphilus** n. sp. (Plate v, fig. 7.)

A single female taken from a Killdeer Plover, *Ægialitis vocifera* (Lawrence, Kansas). Packard's outline figure and incomplete description of *Lipeurus gracilis*, host? (Amer. Nat., 1870, vol. iv, p. 95, pl. i, fig. 6) must refer to a form resembling, in shape and markings, at least, this species. The new species belongs to the group *obscuro-suturati*.

Description of female. Body, length 1.95 mm., width .34 mm.; very elongate and slender, parallel-sided, pale with distinct brown marginal bands on head, thorax and abdomen, and with weakly colored and ill-defined transverse abdominal markings.

Head, length .48 mm., width .23 mm.; elongate, conical, with clypeus expanded, and obtusely angled in front and at sides; the expanded part of the clypeus is uncolored; one lateral hair on expanded clypeal portion, two in front of the suture (one rising from dorsal surface and one from ventral), one at the suture, and two rising from the ventral surface and projecting beyond the lateral margin behind the suture, and one long hair rising from the internal band and projecting beyond the lateral margin of the forehead; trabeculæ small but distinct, acute; temporal margins subparallel, with one long hair and one shorter hair; occipital margin concave; eyes inconspicuous; antennæ with second segment longest, fifth next, third next, fourth next, segment 1 short and thick, uncolored, except a faint brownish tinge on segment 5; clypeal signature triangular with apex toward the mandibles; entire lateral margin of head narrowly dark brown, interrupted at clypeal suture and emphasized at beginning of antennal band; uncolored occipital bands converging toward the mandibles, and uncolored internal bands bending outward at suture to meet antennal bands and in front of mandibles to enclose oral fossa.

Prothorax truncated, conical, sides converging in front, with well defined brown marginal bands around the entire segments, and a single hair at posterior angle. Metathorax but little longer than prothorax, wider, also truncated conical with lateral brown bands interrupted at middle, and three long hairs in posterier angle, and one pustulated hair on each latero-posterior margin; a median, long, spear-head shaped sternal blotch of pale brown showing through. Legs with colored tarsi and strong claws.

Abdomen very long, slender, parallel sided, with few scattered long hairs on surface and in posterior angles of segments; segments 8–9 tapering posteriorly; segment 9 slightly but angularly emarginated, without terminal hairs on points; all segments with distinct narrow lateral brown bands, slightly expanding at front of each segment and projecting across the sutures; segment 1 with truncated, conical, paler, median blotch; other segments with indistinct, large, quadrangular, median blotches.

**Nirmus punctatus** Nitzsch. (Plate vi, figs 1 and 2.)

Germar's Mag. Entomol., 1818, vol. iii, p. 291.

*Philopterus grammicus* Gervais, Hist. Nat. Apteres, 1847, vol. iii, p. 350.

*Nirmus punctatus* Nitzsch. Nitzsch. (ed. Giebel) Zeitschr. f. ges Naturwiss., 1866, vol. xxviii, p. 377; Giebel, Insecta Epizoa, 1874, p. 176, pl. iv, figs. 1, 2; Piaget, Les Pediculines, 1880, p. 200, pl. xvi, fig. 4.

A female and two immature specimens taken from a Western Herring Gull, *Larus occidentalis* (Bay of Monterey, California). This species was found by Nitzsch on *Larus ridibundus*, and by Piaget on a *Larus dominicanus* from Chili, a *Larus crassirostris* from China, and a *Larus ichthyaëtus* from the Volgas; a well distributed form, surely. Piaget's figure omits the short hairs at the anterior angles of the clypeus present apparently in all *nigropicti*, and his description consistently with the drawing refers to but three hairs on each side of the clypeus, where there are really four. The specimen is much larger (length 2.4 mm.) than Piaget's seem to have been, the average length of his female specimens being 1.9 mm.

Description of young. Length, 1.5 mm., differing from adult specially in incompleteness of markings and relative shortness of body. Head, length .5 mm., width .41 mm.; more rounding than truncate in front and without colored markings, except dark brown labrum and pale brown mandibles; ratio of breadth to length greater than in adult. Thorax with a lateral small black blotch near anterior angle of metathorax. Abdomen, length .81 mm., width .42 mm.; without median markings, a small black blotch at anterior angle of segments 1–7, blotches growing smaller in each succeeding segment.

**Nirmus felix** *Giebel.* (Plate VI, figs. 3 and 4.)

Insecta Epizoa, 1874, p. [illegible]

Two specimens, both males, taken from two specimens of Heermann's Gull, *Larus heermanni* (Bay of Monterey, California), may be attributed to this species of Giebel established on a single female taken from the same species of gull. Piaget (Les Pediculines, p. 201) assumes to believe Giebel's specimen a variety of *punctatus*. "Cette espèce ne me paraît non plus qu'une variété du *punctatus* où l'occiput n'est pas bordé de noir et les taches de l'abdomen sont plus allongées transversalement." But the differences between the males taken by me and the male *punctatus* are much more considerable than this. The black bordering of the head and the strong tripartite

Head, length .53 mm., width .50 mm.; conical, clypeus truncate, even slightly concave in front, a short hair at each anterior angle and five other short hairs in the lateral margin between it and the small but distinct trabecula; temporal margin slightly rounding, with two longish hairs, and behind the hinder one two very short, stiff, prickle-like hairs; posterior margin straight; antennæ uncolored, second segment longest, third, fourth and fifth segments about equal; anterior part of clypeus transparent, and a transparent space on each side just inside of trabeculæ; margin of forehead with a twice-interrupted, uneven, black line, the middle third of it not contiguous to the margin and thickly crescentic; a black border along the temporal margins, bending inwards at anterior end; labium black; mandibles chestnut brown.

Prothorax quadrangular, bordered laterally with black, which runs inward along the posterior margin one-third the length of the margin; a single hair at posterior angles. Metathorax pentagonal, bordered on the anterior lateral margins with dark brown, inside of which the short, curving, black, intercoxal lines of the sternum show through; posterior lateral angles with five strong pustulated hairs almost exactly as in *præstans;* posterior margin angulated on abdomen; sternal markings consist of an obtusely-pointed, nipple-like fleck, projecting inwards from lateral margin of metathorax. Legs, femur with brown fleck at basal end and tibia with brown blotch at distal end, tarsus brown, otherwise white; tibia with three short, stiff hairs on inner side and one on outer side; femur with two or three short hairs arising in basal blotch.

Abdomen with segment 4 widest; nearly parallel-sided for most of its length; segment 1 with small black blotch at anterior angles, segments 2–7 with triangular (segments 2–3), or curving, angulated (segments 4–7) blotches in anterior angles, with transparent spots at posterior angles and margins narrowly transparent; segment 8 with irregular black marginal blotch; segment 9 with two short chestnut lines parallel with posterior rounding margin; on dorsal surface of segments 2–6 a median transverse chestnut line shortest on second and on sixth segments, and with anterior border of each mark emarginated; ventral surface of segment 5 with broad transverse chestnut blotch almost divided in the middle; segments 4 and 6 with such blotches completely and widely divided, making two lateral blotches on each segment; segment 3 with faint indications of such lateral blotches; genitalia confined to segments 7–8, side pieces angulated with points projecting inwards and slightly crossing each other at tips; posterior angles of abdominal segments with few long hairs; segment 8 with hairs rising from middle of margin; segment 9 with about twelve hairs along posterior margin which is broadly rounded.

**Nirmus signatus** Piaget. (Plate vi, fig. 5.)

Les Pediculines, 1880, p. 186, pl. xv, fig. 8.

*Nirmus signatus* Piaget, König, Ein Beitrag zur Mallophagenfauna, 1884, p. 10.

Three males and three females taken from an American length 2.5 mm., width .62 mm.; head, length .56 mm., width .4 mm. The characteristic markings of the species, especially the large and sharply-defined signature, make it easily recognized.

**Nirmus pileus** Nitzsch. (Plate vi, fig. 6.)

Germar's Mag. Entomol., 1818, vol. iii, p. 291.

*Nirmus pileus* Nitzsch, Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 373; Giebel, Insecta Epizoa, 1874, p. 162; Piaget, Les Pediculines, 1880, p. 182, pl. xv, fig. 6.

A single specimen, female, taken from an American Avocet, *Recurvirostra americana* (Lawrence, Kansas). Nitzsch's and Piaget's specimens were taken on *Recurvirostra avocetta*. I figure the female, although Piaget's figure is excellent, for the convenience of American students. The measurements of the specimen are: Body, length 2.8 mm., width .78 mm.; head, length .62 mm., width .60 mm. These measurements vary a little from Piaget's, my specimen being shorter and wider, and the head a fifth greater in length and width.

**Nirmus lineolatus** Nitzsch. (Plate vi, figs. 7, 8 and 9.)

Zeitsch. f. ges. Naturwiss., 1866, vol. xxviii, p. 376 (ed. Giebel).

*Nirmus ornatus* Grube, v. Middendorff's sibir. Reise zool., vol. i, p. 477, pl. i, fig. 4.

*Nirmus lineolatus* Nitzsch, Burmeister, Handb. Entomol., 1838, vol. ii, p. 428; Giebel, Insecta Epizoa, 1874, p. 177; Piaget, Les Pediculines, 1880, p. 199.

I have taken this common *Nirmus* of the gulls from *Larus argentatus smithsonianus*, *brachyrhynchus*, *glaucescens*, *canus*, *vegæ*, *occidentalis*, *heermanni*, *californicus*, *delewarensis* (Bay of Monterey, California). Nitzsch found it on *Larus canus*, *argentatus*, *glaucus*, *tridactylus*, and Piaget on *argentatus* and *glaucus*. It is readily distinguishable by its characteristic head markings and by the ventral abdominal blotches and the genitalia of the male. The young, which I have found in many stages of growth, differ from the adult, especially in the shape of the head and the markings of the body.

Description of very young. Body white, with few brown markings. Head short, broadly conical; front rounded; temporal angles with a single long hair; front with two very short hairs on each side (invisible except under high magnification); antennæ rather short and thick, uncolored; mandibles pale brown; a small black ocular fleck; head otherwise uncolored. Thorax shaped as in adult, with but four long metathoracic hairs instead of six; prothorax unmarked; a small fleck at anterior angle of metathorax. Abdomen with sides subparallel; no medial markings; a small lateral marginal blotch on segments 1–7; segments 1–4 without hairs at posterior angles.

**Lipeurus densus** n. sp. (Plate vii, figs. 1 and 2.)

A single female specimen taken from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). The form is a well-marked member of the group *circumfasciata*. As indicated by the clypeus, the simple lateral bands of the abdomen, and the concave posterior margin of the metathorax, it somewhat resembles *heterogrammicus* taken by Nitzsch and Piaget on *Perdix cinerea*.

head, and continuing, interrupted at antennary fossæ, along temporal margins almost to occipital angles.

Prothorax quadrangular, convex on metathorax; two separated hairs at occipital angles; a lateral marginal brown blotch bounded outwardly along its posterior half by a transparent edge. Metathorax with lateral margins concave, deepest before the middle; anterior angles obliquely truncate; posterior margin straight or feebly concave; three long, strong, hairs in the posterior angles, arising from an elliptical uncolored space; a large brown blotch in anterior angles, and a smaller one in posterior angles, also a narrow marginal band running full length of segment. Sternal markings consisting of a faint bordering of anterior coxal cavities, an intercoxal line between pro- and mesacoxæ, an obscure median semicircular blotch with convex margin posteriorly, and a rather broad lateral marginal band on metathorax. Fore legs short, coxæ narrowly separated and globular, femora wide, tarsi alone colored; middle and hind legs long, coxæ produced widely and separated; femora long and slender; femora and tibiæ with dorsal, elongate, dark brown markings; tarsi and claws pale brown; tibiæ with two long hairs and three short ones on outer margin.

Abdomen with sides of segments 1–7 parallel; sides of segments 8–10 tapering posteriorly, tenth segment bicuspidate; posterior angles of segments 1–4 without hairs, angles of segments 5–6 with one hair, of segment 7 with three hairs, segment 8 with one hair rising before the angle, segment 9 with two hairs, segment 10 with each posterior point bearing four hairs, two arising on margin and one each from dorsal and ventral surfaces; a strong broad, dark brown, marginal band, this band projecting in on segment 9 almost to median line; segment 10 wholly colored.

**Lipeurus varius** n. sp. (Plate vii, figs. 3 and 4.)

A common parasite of the Pacific Fulmars, *Fulmarus glacialis* vars. *glupischa* and *rodgersii*, being found by me on twenty-six out of thirty specimens of these Fulmars shot on the Bay of Monterey, California. This white and blotched species belongs to the *Lipeuri circumfasciati*, and shows some similarity of appearance to *tricolor* Piaget (Les Pediculines, p. 363, pl. xxx, fig. 4), taken from an Albatross. Although this parasite was found on nearly all the Fulmars shot, on none was it present in large numbers (as was its companion *Lipeurus celer*), and among all the specimens taken by me, perhaps one hundred in total number, there is not a male.

Description of female. Body, length 2.9 mm., width .62 mm.; white, with distinct dark brown markings, marginal on head and thorax, and as lateral blotches not reaching the margins on abdomen.

Head, length .6 mm., width .4 mm.; sides subparallel, front parabolic, with five marginal hairs on forehead, one of which is separated from the others and close to angle of antennary fossa, and a short hair on dorsal surface projecting beyond the margin between first two marginal hairs; trabeculæ wanting; temporal margins with a single short hair; eyes distinct, with a fine prickle on margin just behind them; occipital margin straight; head uncolored and pale smoky brown, with dark brown circumferential antennal bands and ocular blotches which extend backwards, paling, over temporal region; antennæ uncolored, first two segments about equal, third and fourth equal and shorter, and fifth slightly longer than third or fourth.

Prothorax nearly square, angles rounding, posterior ones slightly swollen; whitish, except even dark brown lateral border. Metathorax elongate, slightly widening posteriorly, anterior angles swollen, posterior margin straight, with four long hairs, not pustulated, in posterior angles; lateral margins unevenly bordered with black and dark brown, widest anteriorly; sternal blotch pale brown, anterior part elliptical, with a backward-projecting, long, slender, tapering process. Legs uncolored except for pale brown tarsi and claws.

Abdomen slightly widening to segment 6, and then more rapidly narrowing; white, with two lateral brown quadrangular blotches, fading inwardly, and each, except on segments 1 and 7–9, with uncolored stigmatal spot; these distinct and characteristic lateral blotches do not touch the lateral margin, the white marginal border varying from very narrow to one-half the width of the blotches, as in the specimen figured; ninth segment angularly emarginated with two hairs on each point.

I figure an immature specimen which is about one-half the size of an adult; it lacks entirely the abdominal markings, showing small portions, but intensely colored, of the thoracic and head markings. The presence of but one of the long metathoracic hairs is interesting, and the usual large head, characteristic of the immature stages, is noticeable.

**Lipeuru celer** n. sp. (Plate vii, figs. 5 and 6).

This large dark form was found in great numbers on all specimens except one of thirty Pacific Fulmars, *Fulmarus glacialis* vars. *glupischa* and *rodgersii* (Bay of Monterey, California), examined by me. It belongs to Taschenberg's group, *clypeati sutura indistincta*, and its most obvious resemblances are to *grandis* taken by Piaget on *Procellaria pelagica* in the Zoological Garden of Rotterdam. It is distinguished from *grandis* by the different form of the head, by lacking the occipital signature, by the presence of occipital bands, by the markedly different abdominal markings, by the different character of the last segment of the male, and by other less obvious characters. Its dark color and large size make it a conspicuous object on the birds.

Description of female. Length 3.37 mm., width .7 mm.; body everywhere brown, the accentuated markings black, sides of head, thorax and abdomen subparallel.

Head, length 7. mm., width .5 mm.; sides nearly parallel; clypeus narrowly rounded in front with six lateral short hairs of which four are located along the margin at nearly equal distances apart, one arising from the dorsal surface near the anterior marginal hair, and one near the antennæ; trabeculæ wanting; temporal margins weakly convex with one long hair; antennæ with segments 1–2 about equal in length, segment 3 but little shorter, segments 4–5 shorter and feebly colored; whole head chestnut brown; clypeal signature wide anteriorly, short, and acuminate posteriorly; the pronounced antennal bands projecting inward at their basal extremities; the irregular orbital blotches, the narrow temporal marginal bands, and the distinct occipital bands much expanded at occipital margin, black or strongly dark brown.

Prothorax short, quadrangular, slightly wider posteriorly; chestnut brown, paler in the middle; lateral borders black. Metathorax widest at posterior angles; brown; lateral margins broadly and irregularly bordered with black; four long hairs arising from an uncolored spot. Sternum almost completely brown, showing a broad long median blotch abruptly pointed behind, set off by narrow uncolored lines from the broad lateral bands. Legs with coxæ, femora and tibiæ dark brown; femora paler on inner side and at distal extremity; trochanters uncolored; tarsi pale brown.

Abdomen with sides nearly parallel; segment 8 narrower and segment 9 very narrow and short; segment 1 shorter than the nearly equal segments 2–7; all segments brown; segments 1–7 with a rather broad, black, lateral, marginal blotch, emarginated on inner face; these blotches touching at the sutures produce a continuous lateral band emarginated on each segment; segment 8 not distinctly blotched, but with narrow lateral black margin; segment 9 slightly emarginated, and with a brown blotch on each side; segment 1 especially, and segment 2 with an ill-defined median blotch of dark brown; the sutures between segments 2–7 showing except at lateral ends as uncolored lines; below, the lateral bands are narrower and not emarginated (or faintly on each segment); segment 1 with distinct median blotch, and segment 2 with a larger indistinct blotch; one or two hairs at posterior angles of segments; on segments 7–9 more hairs.

Male. Body, length 3.44 mm., width .59 mm.; head, length .72 mm., width 5. mm. Antennæ, first joint as long as all others combined, second next longest, third short with a dorsal angular projection at distal extremity, fifth slightly longer than fourth; first, fourth and fifth more colored than others. Abdominal segments with complete transverse dark brown bands, black at lateral margins, and with paler stigmatal spots; ninth segment very small and not emarginated.

Rudow (Zeitschr. f. ges. Naturwiss., 1870, vol. xxxv, pp. 121–137), describes several *Lipeuri* taken on *Procellaria*, and one, *nigricans*, is a form as dark as *celer*, but all of these species are small, *nigricans* being but 1.5 mm. long.

**Lipeurus longipilus** n. sp. (Plate vii, fig. 7.)

A few males and females taken from two specimens (out of ten shot) of the American Coot, *Fulica americana*

(Monterey, California). The species was not present on any one of five Coots taken at Lawrence, Kansas. A well-marked member of the group *clypeati sutura distincta*.

Description of the male. Body, length 2.4 mm., width .4 mm.; fuliginous with paler femora, antennæ, prothorax and posterior half of abdomen, and black marginal bands on head, thorax and abdomen.

Head, length .53 mm., width .35 mm.: elongate, conical, with narrowly parabolic front, four marginal hairs in front of suture and three behind it; temporal margins with one hair, occipital margin straight or feebly concave; no trabeculæ; eyes inconspicuous: antennæ, first segment short, second segment large, broadest at base, almost as long as third, fourth and fifth together, third deeply notched and with an acute claw-like extremity, fourth and fifth short, cylindrical and more strongly colored than other segments; signature shield-shaped, extending to front margin of head, pale-colored anteriorly, with indistinct transverse striæ parallel with anterior margin, dark brown behind, a distinct suture extending from posterior angle along the median line not quite to the anterior margin of signature; this suture also extending posteriorly lateral border of black, widest at constriction. Legs with dark colored coxæ and tibiæ, paler femora with darker markings.

Abdomen elongate, first segment much narrower than thorax at articulation, segments gradually widening to the fifth and narrowing from there to the ninth; segments 5–7 shorter than others; segments 1–2 with one hair at posterior angle, segment 3 with two hairs, and remaining segments with much longer hairs; distinct marginal black bands, with clear segmental spots; transversal dark brown bands, narrower on segments 5–7; ninth segment wholly colored and angularly emarginated, the points each with two short hairs.

Female. Body, length 2.65 mm., width .5 mm.; head, length, .55 mm., width .35 mm.; slightly larger than male; antennæ, second and fifth segments about equal, longest, third and fourth about equal; abdomen with segments gradually shortening from first backward through the seventh, eighth slightly longer, ninth deeply angularly emarginate, the two acute points without hairs; from the dorsal face of the eighth segment two very long hairs arise just inside of the black lateral band; all segments wholly colored except posterior half of the eighth; the transverse sutures uncolored, and indications of an uncolored median longitudinal line on segments 3–6; lateral marginal bands black, with clear stigmatal spots on inner margin.

**Lipeurus picturatus** n. sp. (Plate viii, figs. 1 and 2.)

Four specimens, all female, taken on two specimens of American Coot, *Fulica americana* (Monterey, California), out of ten shot. No specimens found on four Coots killed at Lawrence, Kansas. A finely-marked form, with indistinct suture.

Description of female. Body length [illegible] mm., width [illegible] mm.; slender, parallel-sided, strongly marked with brown and black in regular lunules and bands.

Head length [illegible] mm., width [illegible] mm.; elongate conical with narrowly rounding or parabolic front; a weakly projecting very obtuse angle at suture; six marginal hairs, of which four are grouped about this angle; trabeculae small but distinct; temporal margins with one hair; occipital margin concave; antennae mutilated; segments 2-4, beginning with 2, gradually shorter, fifth segment as long as second; signature broad, paler in front and with indistinct transverse striae parallel with anterior margin, posterior margin concave, and with a broad uncolored median line running from this border nearly to anterior margin; the signature is thus almost divided longitudinally; antennal bands black, extending anteriorly and fading into the paler color of the signature; temporal margins narrowly bordered with blackish and bearing one hair; an acorn-shaped occipital signature indistinctly showing through from under surface.

Prothorax almost square, with posterior margin slightly angulated on the metathorax; clear smoky brown in middle, with black lateral borders expanded in anterior an-entirely across, with narrow marginal black bands, and two quadrangular smoky brown blotches separated from each other and from lateral band by uncolored spaces.

In an immature specimen (plate viii, fig. 2) of about same size as adults, the markings are less intensely colored, the occipital signature and precoxal lines of ventral surface showing through, and the segmental parts of the marginal abdominal bands distinct, so that each segment appears to have four blotches, the outer ones darker.

**Lipeurus diversus** n. sp. (Plate viii, figs. 3 and 4.)

Several specimens taken from the Black-vented Shearwater, *Puffinus opisthomelas* (Bay of Monterey, California). The species is very like, in outline and markings, Piaget's species *angusticeps* (Les Pediculines, p. 306, pl. xxv, fig. 4) from a *Thalassidroma leachi* (Zool. Garden of Rotterdam), but shows such marked difference in size and certain details that it must be looked on as a distinct species.

The measurements of the specimens are (following in parentheses are the corresponding dimensions of *angusticeps* as given by Piaget): Male, body, length 3.4 mm. (2.8 mm.), width .37 mm. (.30 mm.); head, length .7 mm. (.6 mm.), width .37 mm. (.28 mm.). Female, body, length 4.1 mm. (3.65 mm.), width .5 mm. (.46 mm.); head, length .72 mm. (.65 mm.), width .43 mm. (.37 mm.). The description of the species in general is that given for *angusticeps* differing as follows: Male, the posterior border of the signature angularly concave, not straight; the temporal margins with two short hairs instead of one; the antennal colored bands bending inwards at the clypeal suture and continuous with the internal bands which bound the oral fossa; the metathorax with five long hairs on posterior angles instead of two; the legs concolorous with the pale body color, not strongly colored; the last two segments of the abdomen not, as in *angusticeps*, with straight tapering sides bearing six short hairs and the last segment emarginated, but with convex margins with two or three rather long hairs, and the last segment very finely if at all emarginated. Female, the last segment of the abdomen not "*profondément entaillé*," but slightly and narrowly emarginated; also no median uncolored line on the first two segments.

**Lipeurus limitatus** n. sp. (Plate viii, figs. 5 and 6).

Three females taken from a Dark-bodied Shearwater, *Puffinus griseus* (Bay of Monterey, California). This species belongs to the group *clypeati sutura indistincta*, and is the first *Lipeurus* to be found on *Puffinus*.

Description of female. Body, length 2.75 mm., width .41 mm.; slender, parallel-sided, pale with light yellowish brown well defined markings.

Head, length .6 mm., width 4. mm.; elongate, conical, front rounded, with four short marginal hairs, one on dorsal surface between first and second marginal hairs, and one very short hair at antennal angle; trabeculæ wanting; temporal margins with one hair; occipital margin nearly straight; eyes inconspicuous; antennæ with second segment longest, first nearly as long, fifth slightly longer than either the third or fourth, which are equal, concolorous with the head or paler; whole head pale, yellowish brown, with darker marginal bands of forehead connected at front by paler striated clypeal band; a narrow, frontal margin of the clypeus transparent; the rest of the clypeus pale brown, hinder margin emarginated; a brown ocular blotch, and the temporal margins near the eyes feebly browner than head color.

Prothorax short, hexagonal, with latero-anterior margins short and hardly distinct from lateral margins; lateral margins narrowly darker colored than rest of segment; no hairs. Metathorax almost three times as long as prothorax; sides subparallel; hind margin feebly convex or slightly angulated on abdomen; with four long hairs and one short one in posterior angles, the short hair being next to the outermost hair; the lateral margins very narrowly darker edged along their hinder half. Legs concolorous with body, dorsally narrowly darker edged.

Abdomen slender elongate, subparallel-sided, growing slightly wider to segment 7, segments 8–10 tapering; segments 1–7 subequal in length, segment 8 half as long as segment 7, segment 9 shorter than segment 8; segment 10 obtusely two-pointed; very sparsely haired, segments 2–6 with one short hair on margin just in front of posterior angle; a square pale brown blotch on each side of segments 1–7, darker-edged outwardly, and separated by a distinct median uncolored line; blotches of segment 8 meeting, and the markings of segment 9 continuous.

**Lipeurus constrictus** n. sp. (Plate viii, figs. 7 and 8.)

Found on three out of six specimens of the Surf Scoter, *Oidemia perspicillata*, and on one out of six specimens of the White-winged Scoter, *Oidemia deglandi* (Bay of Monterey, California); also found on a specimen of *perspicillata* taken at Lawrence, Kansas (Kansas River, during migration). The new form belongs to the group *bisetosi*, and is distinguished from *squalidus*, the member of the group which the new form most resembles by the smaller size, by the narrow basal abdominal segments, and by the concave hinder margin of the clypeal signature. Many specimens, males, females and young were taken.

Description of the male. Body, length, 2.31 mm., width 5 mm.; general habitus of *squalidus*, but distinctly smaller and with waist-like narrow basal abdominal segments.

Head, length .53 mm., width .41 mm.; temporal margins with five very short stiff hairs or prickles and one longer hair; antennal bands most strongly marked at anterior end, ocular blotch dark brown, and temporal margin broadly banded with brown paling internally. Lateral bands of prothorax darkest at posterior angles. Metathorax with large, lateral, marginal, dark brown blotch in front of the middle, and margin behind the blotch dark brown; hairs seven, as in *squalidus*. Legs concolorous with body, tarsi and claws darker. First two abdominal segments much narrower than succeeding ones, segments 4–5 the widest; segments 3–6 with two hairs, a long one and a short one, at posterior angles; segment 9 feebly emarginated, thus obtusely two-pointed; segment 1 short, segments 2–3 longest and equal, segments 4–5 next longest and equal, segment 6 very short especially in middle, segments 7–8 equal; lateral marginal bands distinct, dark brown; within pale yellowish brown quadrangular blotches separated by uncolored median line on segments 2–4.

The female is larger; body, length 3.12 mm., width .66 mm.; head, length, .63 mm., width .5 mm.; first abdominal segments shorter, segments 2–7 about equal, segment 9 very slightly emarginated.

The young of this species, as probably of all *bisetosi*, show characteristic transparent, narrow, lateral, abdominal margins, and on segments 1–7 along the lateral third of the hinder margin of each segment a linear transparent space; no brown markings.

*Lipeurus punctulatus* of Rudow (Zeitsch. f. ges. Naturwiss., v. xxxvi, p. 137), from *Oidemia fusca* is probably an immature specimen of this species.

**Lipeurus ferox** Giebel. (Plate ix, figs. 1 and 2.)

Zeitsch. f. ges. Naturwiss., 1867, xxix, p. 195.

*Pediculus diomedæ.* Fabr. Ent. Syst., 1794, iv, p. 421.

*Lipeurus diomedæ* Dufour. Ann. Soc. Ent. France, 1834, iv, p. 669, figs. 1 and 2; Giglioli, Quart. Jour. Mic. Sci., 1864, iv, N. S., p. 19, plate i, b, figs. 1, 2.

*Lipeurus pederiformis* Dufour. Ann. Soc. Ent. France, 1834, iv, p. 676, pl. 26, fig. 4.

*Lipeurus ferox* Giebel. Insecta Epizoa, 1874, p. 235. Piaget, E. Les Pediculines, 1880, p. 333. Taschenberg, O., Die Mallophagen, 1882, p. 145, pl. v, figs. 1, 1a.

To this large and striking species may be attributed three specimens, one male and two females, taken from the Short-tailed Albatros, *Diomedea albatrus.* The male was taken from one bird, the two females from another; these two birds, both immature, were the only specimens of this bird species taken on the Bay of Monterey. The various descriptions of *ferox* by Giglioli, Giebel, and Taschenberg differ somewhat; Giebel had only a male before him; Taschenberg had in addition an immature female, and while Giglioli had both sexes his descriptions are incomplete.

Description of female. Body, length 9. mm., tapering from sixth abdominal segment abruptly to tip of abdomen, and gradually toward the head; strongly and distinctly marked with dark brown on both sides of the body for its whole length; a median uncolored line widest on head and on sixth abdominal segment; body nearly glabrous.

Head, length 2.1 mm., width 1.4 mm.; widest behind the eyes; margins of head in front of antennæ nearly straight and oblique; temporal margin feebly rounding; occipital margin weakly concave; clypeal suture distinct; clypeus convex in front, without hairs or bristles: at suture a slight rounded emargination, with one long hair, and behind it five short hairs, farther back one short hair, and in front of insertion of antennæ two short hairs; signature large, broadly triangular with rounded angles, front margin parallel with margin of clypeus: antennæ with first segment uncolored, the remaining four brown, segment 2 longest, segments 1 and 3 about equal, segment 5 shorter than segment 4, each segment with a few short hairs; angles of antennary fossæ not projecting; eyes prominent; temporal margin with a few very short bristles; head broadly margined, widest posteriorly, with dark brown; a dark brown band across the head immediately behind the clypeal signature.

Length of thorax 2.5 mm., width 1.9 mm.; prothorax forming a parallelogram a little wider than long, the angles weakly rounded; lateral borders dark brown, extending inward along the front and hind margins toward the middle, but not reaching it, leaving the middle third of the segment uncolored. Metathorax expanding posteriorly; lateral margins with some small, uneven, rounded projections about the middle; posterior margin slightly concave, angles acute; near each angle near the posterior margin a single pustulated hair, and a little further in seven long pustulated hairs grouped in a small, elliptical, uncolored space; the whole metathorax strongly brown except narrowly along the posterior margin and behind consisting of very dark lateral border and large transverse lateral blotches, those of segment 6 meeting at middle line, others not meeting; an uncolored, median, longitudinal line interrupted on segment 6; on ventral side transverse blotches continuous across all the segments; anterior and posterior margins of each segment narrowly uncolored; an ill-defined stigmatal uncolored spot on segments 2–7; segment 8 conical, much narrower than segment 7, and segment 9 very short and narrow, two-pointed, each point bearing two strong hairs; sparsely haired; posterior lateral angles of segment 1 with one hair, of segments 2–4 with two hairs, of segments 5–6 with three hairs, of segment 7 with four hairs; segment 8 with two strong hairs near anterior lateral angle, two shorter hairs on side and three separated, strong, pustulated hairs on each half of posterior margin.

The male specimen of *ferox* taken by me differs rather markedly in some respects from Taschenberg's careful description of the specimen in his hands. Indeed, it has been a question with me whether my specimens could fairly be attributed to this species.

**Lipeurus forficulatus** Nitzsch. (Plate ix, figs. 3, 4, 5 and 6.)

Zeitschr. f. ges. Naturwiss. (ed. Giebel), 1866, vol. xxviii, p. 386.
*Lipeurus forficulatus* Nitzsch, Giebel, Insecta Epizoa, 1874, p. 238; Taschenberg, Die Mallophagen, 1882, p. 157, pl. iv, figs. 6, 6a, 6b.

Taken from four of five specimens killed of the California Brown Pelican, *Pelecanus californicus* (Bay of Monterey, California), and on two White Pelicans, *Pelecanus erythrorhynchus* (Lawrence, Kansas), the parasites numerous on the birds. Nitzsch's specimens were taken from *Pelecanus onocrotalus* (locality?). My specimens show distinctly the short forked projection on the first segment of the antennæ of the male, the character noted by Taschenberg which distinguishes this species from the otherwise similar form *bifasciatus* Piaget, found on *Pelecanus crispus* (Zool. Garden of Rotterdam).

I figure both sexes, although Taschenberg's figure of the male is good. I figure also two stages of the young. The measurements of the specimens figured are as follows: Male, body, length 2.6 mm., width .62 mm.; head, length .52 mm., width .5 mm. Female, body, length 2.7 mm., width .9 mm.; head, length .56 mm., width .56 mm. Young female, body, length 2.28 mm., width .72 mm.; head, length .5 mm., width .48 mm. Very young, body, length 1. mm., width .44 mm.; head, length .375 mm., width .44 mm.

**Lipeurus temporalis** Nitzsch. (Plate x, fig. 1.)

Germar's Mag. Entomol., 1818, vol. iii, p. 292.

*Ricinus mergi serrati* De Geer, Mem. pour servir a l'hist. des Insectes, 1778, vol. vii, p. 78, pl. iv, fig. 13.

*Pediculus mergi* Fabricius, Species Insectorum, 1781, vol. ii, p. 480.

*Lipeurus temporalis* Nitzsch. Denny, Monograph. Anoplur. Brit., 1842, p. 175, pl. xiv, fig. 7; Giebel, Insecta Epizoa, 1874, p. 239; Piaget, Les Pediculines, 1880, p. 350, pl. xxxi, fig. 1.

Two females and a male taken from a Red-breasted Merganser, *Merganser serrator* (Bay of Monterey, Calispecimens, females only, were taken from *Procellaria capensis* (locality ?).

My adult specimens (three females) differ from Taschenberg's description in these details: the eye has a small hair not mentioned by Taschenberg; the front angles of the antennary fossæ are prolonged into small but distinct trabeculæ; there are five long hairs, not four, in the posterior angles of the metathorax, four hairs rising near together in a clear space and the fifth apart and near the lateral margin. I find distinctly in undoubted adult specimens the ten abdominal segments referred to by Taschenberg, who thought his specimens might be immature. The measurements agree well, those of the adult female figured by me being: body, length 2.50 mm., width .56 mm.; head, length .75 mm., width .53 mm. I figure an adult female and a very young.

**Lipeurus toxoceros** Nitzsch. (Plate x, figs. 3 and 5.)

Zeitschr. f. ges. Naturwiss. (ed. Giebel), 1866, vol. xxviii, p. 386.

*Lipeurus toxoceros* Nitzsch. Giebel, Insecta Epizoa, 1874, p. 237; Piaget, Les Pediculines, 1880, p. 343; Taschenberg, Die Mallophagen, 1882, p. 149, pl. iv, fig. 7.

*Lipeurus gyroceros* Nitzsch (ed. Giebel), Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 386.

An adult male and two young taken on two specimens of Farallone Shag, *Phalacrocorax dilophus albociliatus* (Bay of Monterey, California), and one adult male from a California Brown Pelican, *Pelecanus californicus* (Bay of Monterey, California). The pelicans and cormorants congregate in great numbers on the same rocks in Monterey Bay, and it is not surprising to find a straggling individual of this cormorant parasite on a pelican. Nitzsch's specimen was collected on a *Halieus carbo*, and the specimen described by Nitzsch as *gyroceros*, but declared by Taschenberg to be identical with *toxoceros*, was found on *Halicus braziliensis*.

The adult male figured by me measured as follows: body, length 3. mm., width .8 mm.; head, length .62 mm., width .6 mm.; and the young as follows: body, length 1.9 mm., width .53 mm.; head, length .5 mm., width .5 mm.

**Lipeurus squalidus** Nitzsch. (Plate x, figs. 6 and 7.)

Germar's Mag. Entomol., 1818, vol. iii, p. 292.

*Pediculus anatis* Fabricius, Systema Entomologiæ, 1775, p. 345.

*Lipeurus squalidus* Nitzsch. Gurlt, in Mag. f. d. ges. Thierheilk., 1842, vol. viii, p. 425; Denny, Monographia Anoplurorum Britanniæ, 1842, p. 176, pl. xiv, fig. 5; Grube, Middendorff's Reise, 1859, vol. ii, p. 486; Nitzsch (ed. Giebel), Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 385; Giebel, Insecta Epizoa, 1874, p. 241, pl. xvi, fig. 1; Piaget, Les Pediculines, 1880, p. 344, pl. xxx, fig. 5; Taschenberg, Die Mallophagen, 1882, p. 162.

This common species of the ducks has long been known, and is widely distributed geographically and zoologically. It has been taken on at least a dozen species of ducks, and what have been called varieties of it on still other species. The exact defining of *squalidus* has not yet been accomplished. Piaget declares that four resembling species (*sordidus*, *depuratus*, *frater* and *gracilis*) of Nitzsch and Giebel are simply *squalidus*; Taschenberg agrees with Piaget, and adds that Rudow's species, tion of the species, without attempting, as yet, to indicate varieties by name.

I attribute to this species specimens taken from a Bufflehead, *Charitonetta albeola*, Mallard, *Anas bosca*, and a Ruddy Duck, *Erismatura rubida*, all from Lawrence, Kansas. These specimens vary somewhat among each other, and all from the descriptions of Giebel and Piaget, which descriptions in turn do not agree with each other. The markings of the abdomen seem to be extremely variable, ranging from an indistinct lateral brownish coloration to distinct quadrangular, sharply-emarginated lateral blotches. More striking is the variation in number of the long hairs in the posterior angles of the metathorax. Piaget mentions two short ones, Giebel four, while all of my specimens show seven, varying in length and arranged as shown in figure 7, plate x. The specimen which I figure was taken from a Bufflehead, *Charitonetta albeola*, and will serve as a fairly representative illustration of the species for purposes of comparison. The measurements of this specimen are: body, length 3.3 mm., width .62 mm.; head, length .63 mm., width .44 mm.

**Oncophorus advena** n. sp. (Plate xi, figs. 1 and 2.)

A male and one female taken from the American Coot, *Fulica americana* (Bay of Monterey, California), and a male taken from a Pacific Loon, *Urinator pacificus* (Bay of Monterey, California). Can this last individual be a straggler? The female resembles the female of *Oncophorus minutus* Piaget, and was by me thought to belong to this species until I had found the male, whose appendaged antennæ make it impossible to refer the American specimens to this species. The female also on closer examination differs from the female *minutus* in its distinctly broader abdomen, by possessing four hairs on posterior angles and margin of metathorax instead of two, and by the absence of an uncolored median abdominal line. The new species by the character of the antennæ of the male belongs to the group *docophoroides*.

The genus *Oncophorus* was established by Rudow (Zeitschr. f. ges. Naturwiss., 1870, vol. xxxv, p. 175) for his *Oncophorus schillingi* since removed by Taschenberg to his genus *Eurymetopus*. Piaget has preserved the generic name *Oncophorus* but applies it to a group of widely removed *Nirmus*-like small forms. Eight species have been described, of which seven are found on wading birds. Piaget says of the genus that it serves as a natural transition between the genera *Docophorus* and *Nirmus* on one side, and *Goniodes* and *Lipeurus* on the other.

Description of the male. Body, length 1.15 mm., width .4 mm.; small, pale with dark brown lateral abdominal bands on all except last three abdominal segments.

Head, length .34 mm., width .32 mm.; front parabolic with a few short hairs rising from the dorsal surface on each side of the middle of the front projecting over the margin; trabeculæ short, wide at base appearing equilaterally triangular in shape; antennæ with first segment much enlarged, third segment with a distinct appendage, fourth shorter than fifth; eye at about middle of the head, flatly convex with a hair; temporal margins straight, diverging posteriorly with three short spiny hairs; in the posterior angles a very long strong hair, reaching to the posterior margin of the first abdominal segment; just behind this hair a spine, and on the occipital margin two short, strong, spiny hairs inserted even with the lateral margins of the prothorax; occipital margin sinuous; color, pale golden; antennal and ocular bands dark, subtranslucent and curving.

Prothorax, subquadrangular with anterior end projecting beneath the head, and anterior margin emarginated, posterior margin weakly convex; a long, strong hair in each posterior angle; pale golden, anterior angles darker. Metathorax not longer than prothorax, wider, with lateral angles rounded and with two long hairs inserted very closely together; on the posterior margin on each side two long hairs inserted very closely together; posterior margin convex and obtusely angulated on the abdomen; pale golden brown, with darker spots on anterior margin near the anterior angles. Legs concolorous with body, or slightly paler.

Abdomen short with subparallel sides, posterior angles projecting slightly, and with two or three rather long hairs; a double longitudinal line of weak hairs along dorsi-meson; lateral bands smoky brown fading out on posterior segments; last segment truncate behind, with a few very short inconspicuous hairs on posterior margin; genitalia distinct, with two backward projecting prongs and two longer forward projecting prongs reaching fourth segment.

Female, body, length 1.28 mm., width .5 mm.; head, length .4 mm., width .4 mm.; head less "square" in appearance, more tapering, temporal margins convex not straight; antennæ with second segment longest, third and fourth equal and fifth slightly longer than fourth; lateral bands of abdomen much more strongly marked and posterior angles of abdominal segments projecting more; last segment of abdomen rounding with slight emargination.

**Eurymetopus taurus** Nitzsch. (Plate xi, figs. 3, 4, 5 and 6.)

Zeitsch. f. ges. Naturwiss., 1866, vol. xxviii, p. 385 (ed. Giebel).

*Philopterus brevis* Dufour, Ann. d. l. Soc. Ent. France, 1835, vol. iv, p. 674, pl. xxxi, fig. 3.

*Docophoroides brevis* Giglioli, Quart. Jour. Mic. Science, 1846, vol. iv, p. 18, pl. i, B, figs. 3, 4.

*Lipeurus taurus* Nitzsch, Giebel, Insecta Epizoa, 1874, p. 234; Piaget, Les Pediculines, 1880, p. 332, pl. xxxi, fig. 3.

*Eurymetopus taurus* Nitzsch, Taschenberg, Die Mallophagen, 1882, p. 183, pl. v, figs. 8, 8a.

Many specimens, males, females and young, taken from two specimens of the Short-tailed Albatross, *Diomedea albatrus*, shot on the Bay of Monterey, California. Also found on two out of thirty specimens of the Pacific Fulmar, *Fulmarus glacialis* vars. *rodgersii* and *glupischa*, taken in the Bay of Monterey, California. This species has been found by Nitzsch, Swinhoe, Dufour and Meyer on *Diomedea nigripes*, *exulans* and *brachyura*. The specimens taken by me differ in some slight details from Taschenberg's careful description, notably in the longer and narrower signature and in their much smaller size, both males and females being less than three-fourths as large as the specimens (Nitzsch's) measured by Taschenberg, and about three-fourths the size of Piaget's specimens. The measurements of my figured specimens, as compared with Taschenberg's measurements, are as follows (Taschenberg's figures in parentheses): Male, body, length 3.12 mm. (4.13 mm.), width 1.18 mm. (1.75 mm.); head, length .9 mm. (1.25 mm.), width 1. mm. (1.52 mm.). Female, body, length 3.40 mm. (4.38 mm.), width 1.5 mm. (1.62 mm.); head, length .95 mm. (1.25 mm.), width 1. mm. (1.56 mm.). Taschenberg's figures are in bad shape; he evidently attributes to the male the measurements of the female and *vice versa*, as he makes the male the larger. In the above comparison I have transposed his figures. Also he attributes to the male (= female) a thorax almost twice as long as that of the female (= male)! This is an obvious error. Despite the conspicuous difference in size and a few other minor ones, I incline to attribute my specimens to Nitzsch's species rather than to call them new.

The blotches on the ventral side of the abdomen of the male, described by Piaget and said by Taschenberg to be wanting on his specimens, are plainly present in mine. As both Piaget and Taschenberg figure the male, I figure the female, the head of the male, and an immature male and immature female. This last shows an interesting stage in the formation of the lateral abdominal blotches, there being two blotches on the lateral portion of each segment, which fuse to form the large blotch of the adult stage. The short round abdomen and peculiar marking of the head are also striking. The measurements of the young female figured are: body, length 2.15 mm., width 1.25 mm.; head, length .65 mm., width .8 mm. The immature but nearly grown male is as large as the adults.

### **GIEBELIA** gen. nov.

By this name (given in honor of Prof. C. G. Giebel) I would designate a *Docophorus*-like form of which several specimens (males and females) of a single species were taken from specimens of the Black-vented Shearwater, *Puffinus opisthomelas*. The distinguishing characters of the new genus are its *Docophorus*-like form, with very short, broad, suborbicular abdomen (in the single species yet known six-sevenths as broad as long); size of body and shape of abdomen same in both sizes; large head; produced rectangular anterior angles of temporal margins with the large eye in the angle; antennæ arising in an antennal emargination; conspicuous trabeculæ, a transparent, semilunar, transversal, membranous flap or process on the forehead with, in the male, a conspicuous, angulated, lateral lobe projecting over the lateral margin of the forehead about midway between the trabeculæ and the anterior angles of the clypeus, in the female barely produced beyond the margin; strong, obtusely toothed mandibles; labium with short but distinct apraglossæ with five short spines on tip of each; antennæ similar in both sexes; abdomen turbinated, with dark lateral bands and brown transverse bands.

**Giebelia** (nov. gen.) **mirabilis** n. sp. (Plate xi, figs. 7 and 8.)

Four males and five females taken from six out of seven individuals of the Black-vented Shearwater, *Puffinus opisthomelas*, shot on the Bay of Monterey, California. The only species of *Giebelia* yet found.

Description of the male. Body, length 1.28 mm., width .56 mm.; short, broad (abdomen six-sevenths as broad as long); pale ferrugineous with dark brown to black markings; abdomen with strongly colored lateral bands and paler transversal bands.

Head, length, .45 mm., width .45 mm.; front broad, truncate with very narrow uncolored margin; one short hair in anterior angle; on lateral margin in front of projecting transparent flap two short hairs; lateral projecting part of crescentic, transversal, transparent flap as long bare; four dark brown pointed papilla-like processes projecting upwards from dorsal surface of head, one at basal extremity of each antennal band, and one on each side in front of mandible; signature broad extending to mandibles; antennal bands dark brown, angulated, paler along lateral margins of clypeus in front of the flap; mandibles large and strongly colored, forming a broad dark brown transversal line connecting the antennal bands; occipital bands distinct, dark brown, diverging, black at base and biramose; suborbicular occipital signature with two short divergent posterior projections indistinctly showing through from under surface.

Prothorax short, broad; anterior angles, lateral margin and posterior angles rounded; a single hair at posterior angles; a broad, distinct, dark brown, lateral border. Metathorax broad, with angulated lateral margin, a pustulated hair and spine in each angle, and five more hairs, some pustulated and longer than the others, unevenly spaced along the lateral part of convex posterior margin; anterior portion of lateral margin with broad, distinct, dark brown border, with strongly colored process projecting posteriorly into the segment. Sternal markings composed of angulated intercoxal lines between meso- and meta-legs, and two small oblong spots darkest at posterior end on sternum between middle legs. Legs concolorous with body with narrow darker margins, tibiæ with three, short, strong spurs on distal extremity opposed to tarsal claws.

Abdomen short, broad, turbinated, with one or more hairs in each projecting posterior angle; a double row of short hairs down the middle of dorsal aspect; well defined, broad, black, lateral bands extending from segment 2 to segment 8, with uncolored stigmatal spots on inner margin of bands; a rather narrow, somewhat sinuous, brown, transverse bar extending across each segment from lateral band to lateral band; last segment with uncolored anterior angles and broad median blotch; rounded behind with a few short hairs; genitalia extending forward into segment 6, and with most distinct posterior portion (in last two segments) cordate.

Female, length 1.43 mm., width .62 mm.; head, length .5 mm. width .5 mm.; lateral portion of transparent lobe of forehead barely projecting over lateral margin of head; lateral bands of abdomen broadest anteriorly, narrow with inward projecting linear appendages on posterior segments; transverse bands darker in medial portion; last segment broad, flatly rounded.

**Colpocephalum unciferum** n. sp. (Plate xii, figs. 1, 2 and 3.)

Found on one out of five specimens of the California Brown Pelican, *Pelecanus californicus* (Bay of Monterey, California); and on one out of two specimens of the American White Pelican, *Pelecanus erythrorhynchus* (Lawrence, Kansas). This well marked species shows a resemblance to Giebel's (Nitzsch's) figure of *C. eucarenum* (Insecta Epizoa, pl. xiv, fig. 1), taken from *Pelecanus* a weak hair, a short thick pointed spine, a shorter hair, two longer hairs, a shorter hair, and in the expansion in front of the ocular emargination four rather stiff longish bristles, the second being the longest; palpi just projecting beyond the margin, and antennæ projecting by all of the last segment which is diagonally truncated; the eye is inconspicuous but double, the anterior half being the more prominent; in the ocular emargination several hairs, and a fringe of short thick-set hairs extending back to the middle of the temporal margin; on the temporal margin several prominent hairs, of which two are very long; occipital margin concave, bare; two large, black, occipital triangles extending forward, and paling and tapering rapidly, as occipital bands; a broad occipital black border connecting the triangles; large, black, ocular blotches, and an uneven, curving, dark brown, inner band, running from the ocular blotches to the frontal margin, the anterior end of these bands expanded and darker.

Prothorax short, angularly elliptical, with a series of seven hairs along each lateral half of the posterior margin, beginning with a short spiny hair in the apex of the lateral angle; whole segment pale golden brown, with a paler narrow transversal blotch in front of the middle. Metathorax short, broad, trapezoidal, lateral margin with short spiny hairs; color pale brown, darker laterally. Legs long, femora thickened, tibiæ slender, expanding distally, especially the tibiæ of the forelegs; tarsi one-half as long as tibiæ; color pale golden brown, with dark brown markings on dorsal aspect of femur and tibiæ.

Abdomen elongate, widest at fourth segment and gradually narrowing in both directions; ends of segments projecting on the sides and armed with stiff, sharp-pointed hairs, especially in posterior angles; segments 6–9 with a pair each of very long hairs; ninth segment broad and flatly rounded behind, posterior margin with several longish hairs; lateral ends of segments dark brown (dark region quadrangular) and a paler, transverse band running clear across each segment and covering all of its surface, paler in its median portion; sutures paler to uncolored.

Female, length 2.19 mm., width .62 mm.; abdomen rather fusiform in shape, segment 2 the widest; segment 9 elongate, tapering, with a series of six short, strong, recurved hooks on the front half of each lateral margin; posterior margin broadly obtusely angled and thickly beset with stiff hairs; from the middle of each lateral segmental margin arises a pair of long hairs; the lateral margins of the abdomen are darker, black in some specimens, than in the male.

An immature specimen, 1.56 mm. long, showed as its only markings the ocular blotches, the anterior ends of the inner bands and a short linear marking on occipital margin; all of these markings were distinct and black.

**Colpocephalum uniforme** n. sp. (Plate xii, fig. 4.)

A single female taken from an American Avocet, *Recurvirostra americana* (Lawrence, Kansas). This species closely resembles *grandiceps* Piaget (Les Pediculines, p. 558, pl. xlvi, fig. 7), taken on *Hæmatopus ostralegus*, but differs from it in the number and arrangement of the long hairs on the head, thorax and last abdominal segment, and in the markings.

Description of female. Body, length 2.34 mm., width .75 mm.; elongate, pale golden brown, with very little darker markings; the small ocular blotches, occipital margin, and narrow lateral margin of metathorax and abdomen black.

Head, length .4 mm., width .6 mm.; ocular emargination less deep than usual; front rounded, almost a semicircle, the contour being slightly irregular because of a small, medial, angled projection, and a shallow almost imperceptible concavity behind the slight but distinct, obtuse, anterior angles; four hairs between the medial frontal angle and the latero-anterior angle of which the last hair is the longest, a very short hair in the anterior angle and a hair just in front of the projecting palpus tip; four hairs, of which one is long, in the lateral angle in front of the ocular emargination; the eye large with a slight emargination, the front half projecting further than the posterior half; the hairs of the ocular fringe larger than usual, the fringe extending but slightly on the margin of the broad temporal region; temporal margin with three long hairs and several short ones; occipital margin concave, bare. Color of head pale golden brown, with small black ocular blotches and narrow black border on outer temporal and occipital margins; indistinct narrow brown occipital bands, the black occipital margin expanded at their bases.

Prothorax with a spine and long hair in produced lateral angles, and a number of long hairs in obtuse latero-posterior angles; the posterior margin seems to be bare; golden brown with small latero-anterior dark brown blotches and very narrow dark brown border between lateral and latero-posterior angles. Metathorax showing no marginal constriction at line of union of meso- and metathorax; sides bare; produced posterior angles with two long hairs and two stout spines; posterior margin straight, bare; whitish, with narrow dark brown to black lateral border expanded slightly in anterior angles. Legs concolorous with body with very narrow dark brown dorsal margins of femora.

Abdomen elongate with long hairs in posterior angle of segments, and short hairs along lateral margins; a narthe posterior margin of the emargination as a narrow black border, and still more narrowly and unevenly margining the temporal region; the inner bands indistinct, chestnut brown.

Prothorax broad (three-fourths as broad as head), short, posterior border rounded with a series of seven strong hairs beginning in the apex of the lateral angle; color pale yellowish brown. Metathorax short, broad, expanding rapidly posteriorly, anterior angles rounded, posterior angles produced, acute, with a short spine and a strong, long hair which is the terminal one of a series ranged along the straight posterior margin of the segment; sides bare. Color of prothorax light brown with a narrow dark brown or black uneven marginal blotch and a broad and transverse band of fuscous. Legs concolorous with body, with dark fuscous markings.

Abdomen broadly ovate, posterior angles of segments slightly projecting with one or two strong hairs and adjacent short ones; a series of strong hairs along posterior margin of each segment, and numerous other shorter hairs; each segment except last with a lateral marginal curving black blotch produced inwardly; also a transverse fuscous band extending entirely across each segment paler medially and darker on segments 7 and 8; ninth segment large, broad, rounded behind, posterior margin with two pairs of strong hairs on each side of the middle, whole segment uniformly fuscous.

**Colpocephalum timidum** n. sp. (Plate xii, fig. 6.)

Two females from a Golden Plover, *Charadrius dominicus* Lawrence, Kansas. The new species resembles *ochraceum* Nitzsch (Germar's Mag. Entomol., 1818, vol. iii, p. 299), somewhat.

Description of female. Body, length 1.94 mm., width

.37 mm.; pale brown, with small black markings on head and thorax, and dark brown markings on abdomen.

Head, length .36 mm., width .53 mm.; palpi not projecting, antennæ slightly projecting; front bare; lateral margin in front of ocular depression with four hairs of which one is long; eye with slight but distinct emargination; ocular fringe distinct; temporal margin with four long hairs, of which one, the third, is very long, and a few short hairs; occipital margin concave; pale yellowish brown, with small dark brown to black ocular blotches, and narrow occipital border expanded at bases of the very faint occipital bands.

Prothorax, with spine and hair on lateral angles, and close to the angle on latero-posterior border a hair; in latero-posterior angles a single hair, and along rounded posterior margin two very short hairs and two longer ones; without dark markings, although the lateral angles and borders appear darker because of sternal markings showing through; also the median sternal blotch faintly showing through. Metathorax with angular emargination on sides showing line of fusion of meso- and metathorax; anterior angles rounded; sides bare; posterior angles with a spine and two strong hairs; anterior angles bordered with black; lateral margins unevenly bordered with brown in which there is on each side a short linear black mark cutting off the region of the posterior angles. Sternal markings consisting of a median blotch on prothorax, a paler and more indistinct large median blotch on metathorax, and dark intercoxal lines. Legs concolorous with body; all femora thickened.

Abdomen, nowhere strongly colored or marked; an uncolored longitudinal line running parallel with each lateral margin on segments 1–8; outside of this line on each segment an ill-defined fuscous blotch showing as its most distinct portion a short transverse line, especially noticeable on segments 1–6; the posterior angles of the segments, which hardly project, bear each a long hair, a very few scattered small hairs on lateral margin; numerous short non-pustulated hairs scattered over the surface of the body; last segment pale with two longish lateral marginal hairs, and convex behind with a short fringe of fine transparent hairs.

**Colpocephalum funebre** n. sp. (Plate xii, fig. 7).

Two females from two specimens of the Glaucous-winged Gull, *Larus glaucescens*, Bay of Monterey, California. This species resembles *fuscipes*.

Description of female. Body, length 3.1 mm., width 1.5 mm.; large with comparatively small head and thorax; dark brown, with black markings.

Head, length 5 mm., width .78 mm.; palpus barely or not at all projecting beyond margin of forehead; antenna projecting slightly; front flatly rounded with eleven hairs on each side between middle of front and ocular emargination, of those on the true front the second and fifth longer than the others and of those on the side one very long; ocular emargination deep, narrow; eye large, simple, hemispherical, the ocular fringe prominent; of the hairs on the temporal margin four are long; occipital margin not deeply concave, bare; color dark brown with a narrow black border extending more or less distinctly entirely around the head; on the sides of the forehead the border is broken into spots, and along the front it is sinuate and is narrowly margined in front by a pale, almost uncolored space; on each lateral region of the forehead there are three small circular uncolored spots from each of which arises a short hair; on under side of head, a distinct large occipital signature; narrow occipital bands bending outward anteriorly, and a narrow black line bounding the oral fossa.

Prothorax, narrow, short; lateral angles obtuse, produced, and with a spine and long hair; in latero-posterior angle a long hair, and in addition two posterior marginal hairs on each side of the middle; color dark brown with narrow black lateral border, and a very narrow transverse line across the segment in front of the middle. Metathorax, sides bare, posterior angles with two spines and a long hair; posterior margin with a few hairs; color dark brown with darker irregular broad lateral border and large trapezoidal median blotch (sternal marking showing through) limited to metathorax; a distinct paler-colored sutural line between meso- and metathorax, with slight angular emargination on the sides; mesothorax with a paler-colored narrow median line separating the dark quadrangular lateral blotches. Sternal markings consisting of a median irregularly octagonal blotch on prothorax, behind it a Y-shaped line running across mesothorax and connecting with a large pentagonal metathoracic blotch with apex directed anteriorly; in addition broad lateral and coxal borders. Legs long, fore femora greatly thickened, middle femora not so much so and hind femora but little thickened; with scattered prominent hairs; concolorous with body.

Abdomen, very large, elongate oval, with one long hair in posterior angles of segments and several short ones along sides and in angles; a series of about twenty pustulated hairs along posterior margin of segments 1–7; these series extending laterally only to a pale-colored longitudinal line running parallel with the lateral margin of body and about .16 mm. from it. Color dark brown, with narrow black lateral border interrupted by sutures; and extending in on each segment along posterior margins to the pale longitudinal line, and along anterior margin not quite to this line; broad transverse bands extending across each segment between the pale longitudinal lines; last segment with three blotches and rounded, hair-fringed posterior border.

**Colpocephalum laticeps** n. sp. (Plate xii, fig. 8.)

A single male specimen from an American Egret, *Ardea egretta* (Lawrence, Kansas). This small and well-marked species cannot be referred to any one of the *Colpocephali* described by Nitzsch from various species of *Ardea*.

Description of male. Body, length 1.72 mm., width .72 mm.; dark golden brown, abdomen with distinct dark fuscous transverse bands.

Head, length .31 mm., width .62 mm.; just twice as wide as long; front broadly rounded with hairs on each side of the middle, as follows: a very short one, another and another, all some distance apart, and in the lateral angle in front of the ocular emargination four, of which two are long; the eye undivided but with a faint medial emargination and with a single black fleck in it; the ocular fringe not extending on the temporal margin; this margin with several short, fine, stiff hairs and three unevenly long pustulated ones; also a long pustulated hair arising from nearly the center of the temporal region; occipital margin not deeply concave, with four hairs; color pale smoky brown, ocular blotch black, bordered irregularly with dark smoky brown which extends backwards as an indication of occipital bands and forward as a suggestion of inner bands; temporal margin narrowly bordered with blackish brown; occipital margin narrowly bordered with black, widest along middle third of head.

Prothorax comparatively long and narrow (the width is always greater than the length among the *Colpocephali*), with conspicuously obtusely produced lateral angles bearing a spine and a long hair; the lateral margin between this lateral angle and the rounded posterior angle slightly concave and bare; posterior angle with a long hair followed by a short stiff hair, and by three long pustulated hairs along each half of the posterior margin; color fuscous with a darker, narrow, transverse line before the middle, and two similarly colored, narrow, curving lines running subparallel with the lateral margins. Metathorax trapezoidal, with posterior angles projecting beyond the sides of the abdomen; these angles with some short stiff hairs and the first of a series of ten long hairs ranged along the posterior margin; lateral margins bare and with a slight constriction in front of the middle indicating the line of fusion of meso- and metathorax; color fuscous with darker, almost black, triangular blotch in posterior angles, and a rather broad, pale, almost uncolored transverse line at line of fusion of meso- and metathorax.

Abdomen rather broadly elliptical with projecting ends of segments; one long and several shorter hairs on each posterior angle, and a series of about twelve hairs along the posterior margin of each segment. Color pale at sutures, black interrupted (by sutures) lateral bands, and a dark brown transverse band extending entirely across each segment; ninth segment broadly rounded behind with narrow transparent margin thickly set with a fringe of short sharp-pointed transparent hairs.

**Ancistrona gigas** Piaget. (Plate xiii, figs. 1 and 2.)

Les Pediculines, Supplement, 1885, p. 117, pl. xii, fig. 8.

Several specimens, ♂, ♀ and ⊙, of this remarkable form from four individuals of the Pacific Fulmar, *Fulmarus glacialis* vars. *rodgersii* and *glupischa* (Bay of Monterey, California). Piaget described the species from a single female taken from *Procellaria glacialis*. His description is excellent. The males differ from the females very little, the recognizable character being the hairless condition of the posterior border of the last abdominal segment. On each lateral margin of this segment there is a small group of short uncolored hairs, rather thick at base. I figure the male and an immature specimen. The immature specimen is without markings, except for a black fleck in the posterior angle of head, and a weak indication of the prothoracic lines. The head and thorax are of pale brownish, the abdomen whitish tinged with buffy. The measurements of the specimens figured are as follows: Male, body, length 5.5 mm., width 2.65 mm.; head, length .7 mm., width 1.87 mm. Young, body, length 2.6 mm., width 1.2 mm.; head, length .5 mm., width 1. mm.

**Trinoton lituratum** Nitzsch. (Plate xiii, fig. 3.)

Germar's Mag. Entomol., 1818, vol. iii, p. 300.

*Trinotum lituratum* Nitzsch, Burmeister, Handbuch d. Entomologie, vol. ii, p. 441; Giebel, Insecta Epizoa, 1874, p. 260, pl. xviii, fig. 10.

*Trinoton squalidum* Denny, Monograph. Anoplur. Brit., 1842, p. 235, pl. xxii, fig. 3; Giebel, Insecta Epizoa, 1874, p. 259.

*Trinoton lituratum* Nitzsch, Piaget, Les Pediculines, 1880, p. 597, pl. xlix, fig. 7.

A few specimens taken from the Pintail, *Dafila acuta*, and the Buff-breasted Merganser, *Merganser serrator* (Lawrence, Kansas). Nitzsch's original specimen was found on *Mergus albellus*, and Denny's specimens were taken from *Anas clypeata*. Piaget found the species on *Dendrocygna arborea* and *Anser albifrons* (Zool. Garden of Rotterdam). The species is easily recognized by its short broad outline and its markings. The female figured by me measured as follows: body, length 2.1 mm., width .63 mm.; head, length .5 mm., width .63 mm.

**Trinoton luridum** Nitzsch. (Plate xiii, fig. 4.)

Germar's Mag. Entomol., 1818, vol. iii, p. 300.

(Louse of the Teal) Redi. Experimenta circa gen. Insectorum, 1686, pl. xii (or xi); Albin, Nat. Hist. of Spiders and other curious insects, 1736, pl. 46 (or 45?).

*Trinotum luridum* Nitzsch. Burmeister. Handbuch d. Entomologie, vol. ii, p. 441; Giebel. Insecta Epizoa. 1874. p. 255, pl. xviii, fig. 7.

*Trinoton luridum* Nitzsch. Denny. Monograph. Anoplur. Brit., 1842, p. 234, pl. xxii, fig. 2; Piaget, Les Pediculines. 1880, p. 591, pl. xlix, fig. 3.

*Trinoton gracile* Grube. Middendorff's Reise. vol. i, p. 494, pl. ii, figs. 6 and 6a.

*Trinoton conspurcatum* Nitzsch. Gurlt. in Mag. f. d. ges. Thierheilk., vol. viii, p. 430, pl. iv, fig. 15.

I have taken this common parasite of ducks from the Shoveler, *Spatula clypeata*, the Buff-breasted Merganser, *Merganser serrator*, the Greenwinged Teal, *Anas carolinensis*, the Pintail, *Dafila acuta*, the Mallard, *Anas boscas*, the Widgeon, *Anas americana* (Lawrence, Kansas), and from the Ruddy duck, *Erismatura rubida* (Monterey, California). There is, as has already been said by Piaget, a considerable variation in the individuals of this species, especially in the extent and intensity of the abdominal markings. It seems hardly worth while in the present state of knowledge of the Mallophaga to attempt

An immature specimen taken from a Greenwinged Teal, *Anas carolinensis* (Lawrence, Kansas), is almost as large as the average adult, but is uniformly pale, faintly tinged with clear brownish, showing no markings except a distinct black ocular fleck and the brown mandibles. The dimensions of this specimen are: Body, length 4.5 mm., width 1.43 mm.; head, length .81 mm., width 1.28 mm.

**Læmobothrium similis** n. sp. (Plate xiv, figs. 1 and 2.)

A single specimen from an Eared Grebe, *Colymbus nigricollis californicus* (Lawrence, Kansas). This species is very like Piaget's *emarginatum* (Les Pediculines, 1880, p. 585, pl. xlviii, fig. 8), taken from *Gallinula hæmatopus* (Zool. Garden of Rotterdam), but lacks the occipital bands of the head, has more of the peculiar, short, flattened, stiff points on the front margin of the head, has a very differently shaped prothorax (if Piaget's descripiion and figure are accurate), lacks the strong markings of emargination, and is a slightly larger species. My specimen is probably not adult, but is of not earlier stage than the last nymphal one. Adult specimens will measure a little larger, and will be a little more strongly marked. This genus has not before been found on a pygopodous bird.

Female, body, length 4.4 mm., width .87 mm.; uncolored (weakly pale brownish) with narrow, sharp, brown markings on head and thorax.

Head, length 1. mm., width .78 mm.; ocular emargination slight, contraction of sides of head even with the mandibles strong, sides of forehead slightly converging; front with rounding emargination, angles rounding; on each side of the center of the emargination toward the angle are a short hair, a longer hair arising from ventral surface, two short flattened spines, and projecting over the margin between them a hair arising from the dorsal surface, a long hair, a very short weak hair, and beyond the apex of the angle two flattened spines, the second one longer, and a long hair; the front half of the convex margin of the antennal fossa bears one very long hair and four shorter hairs, and the hinder half three weak, equal hairs arising close together and projecting backwards; the temporal margins bear two long hairs and more than a dozen short, equal ones; occipital margin concave; eyes double, inconspicuous; antennæ concealed in fossæ but showing through, fourth segment subglobular; labial palpi, with thick segments of about equal length, third and fourth segments with a short hair at anterior outward angle; mandibles pale brown with teeth dark brown; ocular flecks black; antennal fossæ rimmed with brown and a curved band, convex behind, across the head between middle points of antennary fossæ; a narrow, long, pale brown triangle projecting back from middle of transverse curving band just described; no occipital bands; in front of mandibles a rounding, pointed, crescent-shaped fossa, convex anteriorly.

Prothorax, subquadrangular, with a narrow anterior neck-like portion which fits into the occipital concavity of the head, sharply set off by a constriction; the posterior margin deeply and broadly emarginate, leaving the posterior angles as obtusely pointed, backward projecting processes underlying the metathorax; behind the frontal constriction the margin is angulated and a long hair and a short one rise from the angle; two black flecks on the frontal margin, a black fleck on each side of the constriction, and a brown lateral marking extending a little way along the middle of the margin. Metathorax and mesothorax continuous in outline with the abdomen; mesothorax indicated by a very slight narrowing near the front of the combined segments; three longer hairs and seven short ones along the margin of the segment; two brown flecks on front margin, and the rounding anterior angles narrowly and weakly margined with brown. Legs, uncolored, except for pale brown at extremities of segments, and very narrow marginal lines; front margins of femora of middle and hind legs with four or five subequal prominent hairs and several very short ones.

Abdomen, parallel-sided for anterior half and then gradually tapering posteriorly; no marginal constrictions between segments; but one or two long hairs in each posterior angle; last segment with one strong long hair and one longer, weaker hair in each posterior angle and a series of six short, equal hairs along posterior margin; margin narrowly lined with pale, clear brownish, and within a parallel, narrow, uncolored line.

**Læmobothrium atrum** Nitzsch. (Plate xiv, fig. 3.)

Germar's Mag. Entomol., 1818, vol. iii, p. 302.

*Pulex fulicæ* Redi, Experimenta circa generationem Insectorum, 1686, pl. iv, fig. 1.

*Læmobothrium nigrum* Burmeister, Handbuch d. Entomologie, 1832, vol. ii, p. 442.

*Læmobothrium atrum* Nitzsch, Denny, Monograph. Anoplur. Brit., 1842, p. 240; Giebel, Insecta Epizoa, 1874, p. 253, pl. xviii, fig. 5; Piaget, Les Pediculines, p. 586.

A single specimen from an American Coot, *Fulica americana* (Monterey, California). The previously taken specimens have been found on *Fulica atra*, also probably one occurrence on *Podiceps rubricollis*. The descriptions vary somewhat and are incomplete, and Giebel's figure shows strange markings of head and thorax, but the large size and dark coloration of the entire body sufficiently identify the species. Giebel's measurements are far under those of my specimen, which are: body, length 8 mm., width 1.9 mm.; head, length 1.4 mm., width 1.17 mm.

**Menopon navigans** n. sp. (Plate xiv, figs. 4 and 5.)

Two males and a young female taken from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). Piaget has found a *Menopon (affine*, Tijdschr. voor Ent., 1890, vol. xxxiii, p. 248, pl. x, fig. 3) on an Albatross *(Diomedea exulans*, a skin in the Leyden Museum), but my new species does not resemble *affine* particularly. *Affine* is a smaller species, with a head more than three-fifths as long as broad; the head of the new species is twice as wide as long.

Description of the male. Body, length 1.8 mm., width .75 mm.; head and thorax pale with dark brown markings; abdomen with large, brown, transverse bands, subparallel-sided; many long bending hairs.

Head, length .34 mm., width .66 mm.; semilunar, front with, on each side, three hairs (of which the second is not strictly marginal), then a very short prickle, then five hairs in front of the ocular region, of which three are long; palpi and antennæ projecting by the length of their terminal segments; temporal margin with two very long hairs, one half as long, two one-fourth as long, and a few short ones; occipital margin concave with four hairs on those of abdomen, in front of which a narrow whitish space broadest medially. Legs concolorous with pale ground color of body, with hairs and thickened femora.

Abdomen oblong, with convex sides and ends, all the segments except 9 being of approximately equal width; especially long hairs in posterior angles and shorter hairs on surface; each segment except 9 with broad transverse brown band covering nearly whole surface of segment and darkest along posterior margin; lateral extremities of bands dark brown to black, forming narrow interrupted lateral bands; segment 9 wholly colored, paler than transverse bands, large, rounding with numerous long hairs.

**Menopon indistinctum** n. sp. Plate xiv, figs. 6 and 7.)

Two females taken from an American Avocet, *Recurvirostra americana* (Lawrence, Kansas). This species most clearly resemble *crocatum* Nitzsch (ed. Geibel, Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 392), from a *Numenius arquata* and *Hæmatopus ostralegus* (Piaget), but there are differences quite as considerable as those which have been used by Giebel and Piaget to separate the various *Menopon* species found on the shore birds. *Crocatum*, *lutescens et. al.* ought, perhaps, to be grouped together as a single species with several varieties, as is done for *Docophorus communis*, the common *Docophorus* of the passerine birds. However I add this species from our Avocet to the group which must sometime be well revised. The noticeable differences between this new species and *crocatum* lie in the number and disposition of the hairs of the head and thorax. The species does not at all resemble Nitzsch's species from the European Avocet, *Recurvirostra avocetta* (*micrandum*, Zeitschr. f. ges. Naturwiss. ed. Giebel, 1866, vol. xxviii, p. 392), which has a thorax without hairs, and an abdomen with uncolored longitudinal lines.

Description of female. Body, length 1.80 mm., width .7 mm.

Head, length .28 mm., width .5 mm.; semilunar; twice as wide as long, front with two short hairs at the middle, and on each side in front of the ocular region two short hairs and a long one; palpi slightly projecting; ocular margin straight or very faintly concave; temporal margin with four long pustulated hairs and several short ones; occipital margin concave with one long pustulated hair on each side; head golden brown with fuscous clouding, occipital margin and ocular fleck black; curving line bounding inwardly the antennal region black inwardly shading into dark brown outwardly; a transversal line even with the mandibles and expanded at outer ends, dark brown.

Prothorax, seven-eighths as broad as head, lateral angles very obtusely rounded, almost truncate, with two spines and a long hair; behind the angle on latero-posterior side a spine, then two hairs, and on the straight posterior margin three hairs on each side of the middle; color smoky brown with a distinct transverse darker line in front of the middle and not reaching the lateral margins; outside of each end of this line a short, slightly curving, longitudinal, dark line; the latero-posterior sides narrowly edged with black. Metathorax just as wide as head, narrow anteriorly with rapidly diverging sides, mesothorax distinctly separated by marginal constriction and dark transverse line; posterior angles of mesothorax bare, sides of meso- and metathorax bare; posterior angles of metathorax with a spine and the terminal one of a series of hairs ranged thickly along the weakly convex posterior margin; metathorax with a broad, transverse, fuscous band across posterior half. Sternal markings composed of small median blotch on prothorax with lateral linear processes; a small pointed blotch with two diverging very small linear processes projecting anteriorly, the whole between strongly curving, inwardly produced intercoxal lines, on mesothorax; and a larger median blotch, truncate behind, convex before, with two small linear points near the posterior angles of median blotch, on metathorax; a smaller semilunar median blotch on first segment of abdomen is also apparaent; the blotches of metathorax and first abdominal segment are beset with numerous short pustulated hairs. Legs pale smoky brown, with darker markings.

Abdomen, elongate oval, posterior angles of segments 1–3 projecting a little; the others barely or not at all; a rather long hair and some shorter ones in each angle; also a series of hairs in small pustulations along the posterior margin of each segment; all segments with a broad, distinct, light fuscous, transverse band whose extreme outer margins are darker; the bands separated by wide, uncolored, sutural lines; last segment, broad, short, uncolored, posterior margin concave with a series of fine short hairs.

**Menopon numerosum** n. sp. (Plate xv, fig. 1.)

An abundant parasite of the Pacific Fulmars, *Fulmarus glacialis* vars. *glupischa* and *rodgersii*, taken on twenty-four out of thirty specimens shot on the Bay of Monterey, California.

Description of male. Body, length 1.44 mm., width .62 mm.; pale yellowish to reddish brown, with transverse abdominal bands, separated by broad, white, sutural bands.

Head, length .28 mm., width .50 mm.; front very obtusely but distinctly angled with two short hairs on each side of the median angle; three long hairs and three short ones before the slight ocular emargination; a sparsely set ocular fringe of short stiff hairs, and in the temporal angles four long hairs and several short ones; occipital margin broadly and shallowly concave and with four hairs; dark brown ocular blotches, distinct black flecks in the eyes, and a narrow, dark brown, occipital border.

Prothorax with posterior margin broadly and evenly rounded with fourteen long hairs in a series extending from lateral angle to lateral angle; a narrow transverse line in front of the middle and a short longitudinal line at each end of the transverse line; the lateral angle regions slightly darker than rest of segment. Metathorax with diverging sides, straight or very flatly convex posterior margin; along the sides three short spines, of which the first two project upwards and the third outwards beyond the margin; in the posterior angles are two long hairs, then a short spine, and then a series of twelve long, strong hairs ranged along the posterior margin. Legs concolorous with body.

Abdomen elongate ovate, with long hairs in the posterior angles of segments and a series of long hairs along the posterior margin of each segment; ground color whitish showing in broad, transverse sutural bands; each segment with a pale, reddish brown, transverse band,

**Menopon infrequens** n. sp. (Plate xv, fig. 5.)

A single female taken from a Glaucous-winged Gull, *Larus glaucescens* (Bay of Monterey, California).

Description of female. Body, length 2 mm., width .81 mm.; brown with chestnut, transverse abdominal bands, narrow black lateral bands, and broadly linear, diagonal, black, ocular blotches.

Head, length .31 mm., width .62 mm., thus being just twice as wide as long; brown with darker fuscous clouds; narrow black occipital margin; black ocular blotches in the form of diagonal bars; some indefinite pale to uncolored spaces, as in the posterior angles, along the front, and a more definite circular space containing a long hair and a spine on each side of the forehead just outside of the origin of the labial palpi; on the front four short hairs near the middle, and on the sides in front of the ocular region two short hairs and one longer but weak hair; temporal angles with three long hairs, one one-half as long and some shorter hairs; occipital margin with four pustulated hairs; on ventral aspect occipital bands showing, enclosing an orbicular occipital signature, with a series of five pustulated hairs along the lateral margins.

Prothorax, with fourteen long, pustulated hairs extending in series from lateral angle to lateral angle along the posterior margin, which in its middle third is almost straight; ground color of segment largely clouded with fuscous to dark brown, especially in lateral angle region, which is very narrowly margined with black; the usual transverse line in front of middle with curving longitudinal lines at the ends especially distinct. Metathorax with lateral emargination and dark brown sutural lines separating mesothorax; posterior margin straight, with a series of not very long hairs, and two or three hairs and a spine in the posterior angles; a fuscous transverse band across posterior half of segment, with its lateral margins black. Sternal markings composed of a small trapezoid on prothorax with the posterior angles produced, and a broad blotch on metathorax; the anterior coxæ are produced forward and backward into broad lobe-like appendages, rounded in front and angulated behind. Legs concolorous with ground color of the body, with darker margins.

Abdomen, elongate ovate, with one long hair and several short ones rising on margin just in front of each uncolored posterior angle, and a series of hairs along posterior margins of segments; segments 1–8 with a broad, transverse, fuscous band darker at lateral extremities and black on extreme lateral margins; segment 9 uniformly colored, broadly rounded with narrow, uncolored, fringed, posterior margin.

**Menopon loomisii** n. sp. (Plate xv, fig. 6.)

Specimens taken from two specimens of the White-winged Scoter, *Oidemia deglandi* (Bay of Monterey, California). Named after Mr. Leverett M. Loomis, Curator of Birds, California Academy of Sciences.

Decription of female. Body, length 1.8 mm., width .84 mm.; pale golden brown to pale chestnut brown.

Head, length .3 mm., width .56 mm.; semilunar with evenly rounding front, shallow ocular emarginations, and rounded posterior angles; occipital margin concave; palpi projecting by the length of the last segment; the antennæ when outstretched projecting beyond the margin of head by the length of the last segment; a pair of very small hairs in middle of front, a longer one on side followed by a very short one, and then two or three longer ones in front of the emargination; the ocular fringe composed of few but rather strong hairs longer than usual; temporal margins with three very long hairs and two more on occipital margin of the produced temples; four additional hairs on the occipital margin; a small, black, ocular fleck, dark brown ocular blotch, the mandibles black-tipped, the other mouth-parts and the basal segments of the palpi brown.

Prothorax with produced lateral angles obtuse, bearing two spines and a long hair, which is the terminal one in a series of fourteen ranged along the rounded posterior margin of the segment; the transverse line with curving vertical lines at its extremities is distinct. Metathorax with divergent sides, not quite as wide as head, with flatly convex posterior margin bearing a series of long hairs; in each lateral angle several small spines and the terminal hair of the posterior series. Legs concolorous with body; with scattered, rather long hairs.

Abdomen ovate, with broad transverse bands across all segments separated by wide uncolored sutures; in the anterior angles of each transverse band a small curving comma-like chitinous band; the segments with fine hairs on lateral margins, and longer weak hairs in the posterior angles; dorsal surface with hairs.

**Menopon titan** Piaget. (Plate xv, fig. 2.)

Les Pediculines, 1880, p. 503, pl. xl, fig. 7.

*Tetraopthalmus chilensis* Grosse, Zeitschr. f. wiss. Zool., 1885, vol. xlii, p. 530.

Many specimens of this species, or of a variety, found on four of five specimens examined of California Brown Pelican, *Pelicanus californicus* (Bay of Monterey, California), and on the White Pelican, *Pelicanus erythrorhynchus* (Lawrence, Kansas). These large conspicuous parasites are found not alone among the feathers of the host but also abundantly clinging to the inner surface of the gular pouch, a circumstance which suggests that feathers may not constitute the exclusive food of the parasites.

Piaget has described two species of these giant *Menopons* of the Pelicans, viz.: *titan* found on *Pelecanus ono-*

*crotalus* (Zool. Garden of Rotterdam) and *consanguineum* (Les Pediculines, Supplement, 1885, p. 116, pl. xii, fig. 7) found on *P. erythrorhynchus* (dried skin in Museum of Leyden). Picaglia has described a third species *ragazzi* (Atti d. Soc. d. Nat. d. Modena, 1885, serie iii, vol. ii) found on *P. trachyrhynchus* (Callao), and has established the subgenus *Piagetia* for the group. The characters of the subgenus are as follows: "abdomen narrow and very elongate; male longer than female; length more than 5 mm." The remaining members of the genus *Menopon* present in contrast these characters: "abdomen oval-elongate, rounded oval, or almost round; male smaller than the female; length varying from 1 to 3 mm." The species chiefly used by Franz Grosse in his study of the anatomy of the Mallophaga was a member of this *Menopon titan* group, taken from a Pelican, undetermined, from Chile.

It certainly seems advisable to indicate the peculiar characters of the group by assigning to it a subgeneric name; but I can hardly recognize in Picaglia's description of *ragazzi* characters other than the dimensions which make it recognizably distinct from *titan*. My specimens from *Pel. erythrorhynchus* show the slight variations from *titan* indicated by Picaglia in his description of *ragazzi*, but the dimensions are quite as large as those of *titan* (Picaglia made *ragazzi* one-fourth shorter than *titan)*! My specimens from *Pel. californicus* closely correspond with Piaget's description of *titan*, except that the transverse abdominal blotches are not bifurcated at the extremities. I believe that the present knowledge of the group hardly justifies any separation of the known forms into distinct species, but that the presence of these variations may be recognized by letting *titan* stand as the representative form of the species *(consanguineum* is evidently a distinct species, the equality in size of both sexes removing any likelihood of confusing it with *titan*), and by designating *ragazzi* and my specimens as varieties presenting the following diagnostic characters:

Var. *ragazzia* Picaglia, from *Pelecaus trachyrhynchus* (Callao); small, length of male 3.42 mm., of female 3.15 mm.; mesothoracic suture indistinct; metathorax a little wider than the head; general color paler than *titan*.

Var. *impar* Kellogg, from *Pelecanus erythrorhynchus* (Lawrence, Kansas); with the minor differential characters of *ragazzi*, but almost as large as *titan*; length of male 4.7 mm., of female 3.8 mm.

Var. *linearis* Kellogg (Plate xv, fig. 2), from *Pelecanus californicus*; about same size as *titan*; length of male 5.2 mm., of female 4.2 mm.; transverse abdominal blotches not bifurcated at extremities, and the longitudinal uncolored lines beyond spiracles very distinct in female, forming an interrupted, uncolored, longitudinal line for full length of abdomen, setting off lateral abdominal bands which are darker than the other abdominal markings.

**Menopon tridens** Nitzsch. (Plate xv, figs. 3 and 4.)

? Germar's Mag. Entomol., 1818, vol. iii.

*Læmobothrium tridens* Nitzsch. Zeitzschr. f. ges. Naturwiss. (ed. Giebel), 1866, vol. xxviii, p. 396.

*Menopon scopulacorne* Denny. Monograph. Anoplur. Brit., 1842, p. 221, pl. 18, fig. 9.

*Menopon tridens* Nitzsch. Burmeister, Handbuch. d. Ent., 1832, vol. ii, p. 440; Giebel, Insecta Epizoa, 1874, p. 296, pl. xvii, fig. 9; Piaget, Les Pediculines, 1880, p. 479, pl. xxxix, fig. 1.

I have taken several specimens of a *Menopon* from Coots, Grebes, and Loons and from a single Tern, which are referable to this species, or at least to the group of forms of which *tridens* is the described representative. The descriptions of *tridens* by Piaget and by Giebel differ positively in various particulars, noticeably in the charracters of the hairs. My specimens agree exactly with neither of these descriptions, and besides differ among themselves in size and shape of head to such a degree that I have arranged them in three groups to which I give, tentatively, varietal rank. These varieties are as follows:

Var. *pacificum* Kellogg, from the Pacific Loon, *Urinator pacificus* (Bay of Monterey, California), and from five specimens out of ten of the American Coot, *Fulica americana*, shot near Monterey, California, and on two specimens out of five of the same bird species from Lawrence, Kansas; measurements, female, length 1.65 mm., width .62 mm.; head, length .28 mm., width .5 mm.; smaller than the succeeding variety which it otherwise resembles.

Var. *insolens* Kellogg (plate xv, figs. 3 and 4), from an Eared Grebe, *Colymbus nigricollis californicus* (Bay of Monterey, California), and from a Forster's Tern, *Sterna forsteri* (Lawrence, Kansas); measurements, female, length 2. mm., width .72 mm.; head, length .31 mm., width .53 mm.; markings distinct and dark; lateral bands of abdomen nearly black.

Var. *par* Kellogg, from a Western Grebe, *Æchmophorus occidentalis* (Lawrence, Kansas); measurements, female, length 2. mm., width .78 mm., head, length .31 mm., width .56 mm.; decidedly paler colors.

As already mentioned none of these varieties agrees with Piaget's or with Giebel's description of the species. The notable differences lie in the dimensions, in the presence through all of the varieties of six hairs on the occipital margin (Giebel says four; Piaget says two); and similarly through all the varieties the clear brown color of the lateral abdominal bands instead of an uncolored condition as affirmed by Piaget. The specimens of Piaget were taken from *Gallinula chloropus;* and his variety *major* based simply and certainly insufficiently on a difference in size amounting to but one-tenth of a millimeter in total length in the female and half that in the male, was taken on *Fulica atra*. Nitzsch found the species on *Fulica atra*, *Gallinula chloropus*, *Crex porzana*, *Podiceps auritus*, *Podiceps cristatus;* Denny found his *scopulacorne* on *Rallus aquaticus*, *Podiceps minor* and *Gallinula chloropus*. The species is easily recognized by the peculiar trilobed process, function unknown, on the under side of the hind-head (see fig. 4, pl. xv).

## EXPLANATION OF PLATES.

PLATE II.—Fig. 1, Alimentary canal and salivary glands of *Menopon mesoleucum* (after Nitzsch). Fig. 2, Alimentary canal of *Docophorus fusicollis* (after Nitzsch). Fig. 3, Nervous system of *Lipeurus baculus*(?) (after Nitzsch). Fig. 4, Female genitalia of *Menopon mesoleucum* (after Nitzsch). Fig. 5, Male genitalia of *Menopon pallidum* (after Nitzsch). Fig. 6, Respiratory system of *Menopon titan* (original). Fig. 7, Head, under side, of *Læmobothrium* sp. (after Grosse). Fig. 8, Labium of *Tetraopthalmus chilensis* [=*Menopon titan*(?)] (after Grosse). Fig. 9, Labium of *Nirmus* sp. (after Grosse). Fig. 10, Antenna of *Tetraopthalmus chilensis* [=*Menopon titan*] (after Grosse). Fig. 11, Antenna of ♀ *Lipeurus*. Fig. 12, Antenna of ♂ *Lipeurus*. Fig. 13, Leg of ♂ *Tetraopthalmus chilensis* [=*Menopon titan*].

PLATE III.—Fig. 1, *Docophorus calvus* Kell., ♀. Fig. 2, *D. fuliginosus* Kell., ♂. Fig. 3, *D. graviceps* Kell., ♂. Fig. 4, *D. acutipectus* Kell., ♀. Fig. 5, *D. quadraticeps* Kell., ♀. Fig. 6, *D. montereyi* Kell., ♂. Fig. 7, *D. occidentalis* Kell., ♀. Fig. 8, *D. kansensis* Kell., ♀. Fig. 9, *D. atricolor* Kell., ♂.

PLATE IV.—Fig. 1, *Docophorus icterodes* N., ♀. Fig. 2, *D. pertusus* N., ♀ Fig. 3, *D. pertusus* N., juv. Fig. 4, *D. lari* Denny; ♀. Fig. 5, *D. insolitus* Kell., ♀. Fig. 6, *D. melanocephalus* Burm., ♀.

PLATE V.—Fig. 1, *Nirmus præstans* Kell., ♂. Fig. 2, *N. præstans* Kell., ventral aspect abdomen of ♂. Fig. 3, *N. hebes* Kell., ♀. Fig. 4, *N. farallonii* Kell., ♀. Fig. 5, *N. orarius* Kell., ♀(?). Fig. 6, *N. giganticola* Kell., ♂. Fig. 7, *N. bœphilus* Kell., ♀.

PLATE VI.—Fig. 1, *Nirmus punctatus* N., ♀. Fig. 2, *N. punctatus* N., juv. Fig. 3, *N. felix* Giebel, ♂. Fig. 4, *N. felix* Giebel, ventral aspect abdomen of ♂. Fig. 5, *N. signatus* P., ♂. Fig. 6, *N. pileus* N., ♀. Fig. 7, *N. lineolatus* N., ♂. Fig. 8, *N. lineolatus* N., ventral aspect abdomen of ♂. Fig. 9, *N. lineolatus* N., juv.

PLATE VII.—Fig. 1, *Lipeurus densus* Kell., ♀. Fig. 2, *L. densus* Kell., ventral aspect head and thorax of ♀. Fig. 3, *L. varius* Kell., ♀. Fig. 4, *L. varius* Kell., juv. Fig. 5, *L. celer* Kell., ♂. Fig. 6, *L. celer* Kell., ♀. Fig. 7, *L. longipilus* Kell., ♂.

PLATE VIII.—Fig. 1, *Lipeurus picturatus* Kell., ♀. Fig. 2, *L. picturatus* Kell., ♀ juv. Fig. 3, *L. diversus* Kell., ♂. Fig. 4, *L. diversus* Kell., ♀. Fig. 5, *L. limitatus* Kell., ♀. Fig. 6, *L. limitatus* Kell., outline of metathorax to show arrangement and character of hairs. Fig. 7, *L. constrictus* Kell., ♀ juv. Fig. 8, *L. constrictus* Kell., ♂.

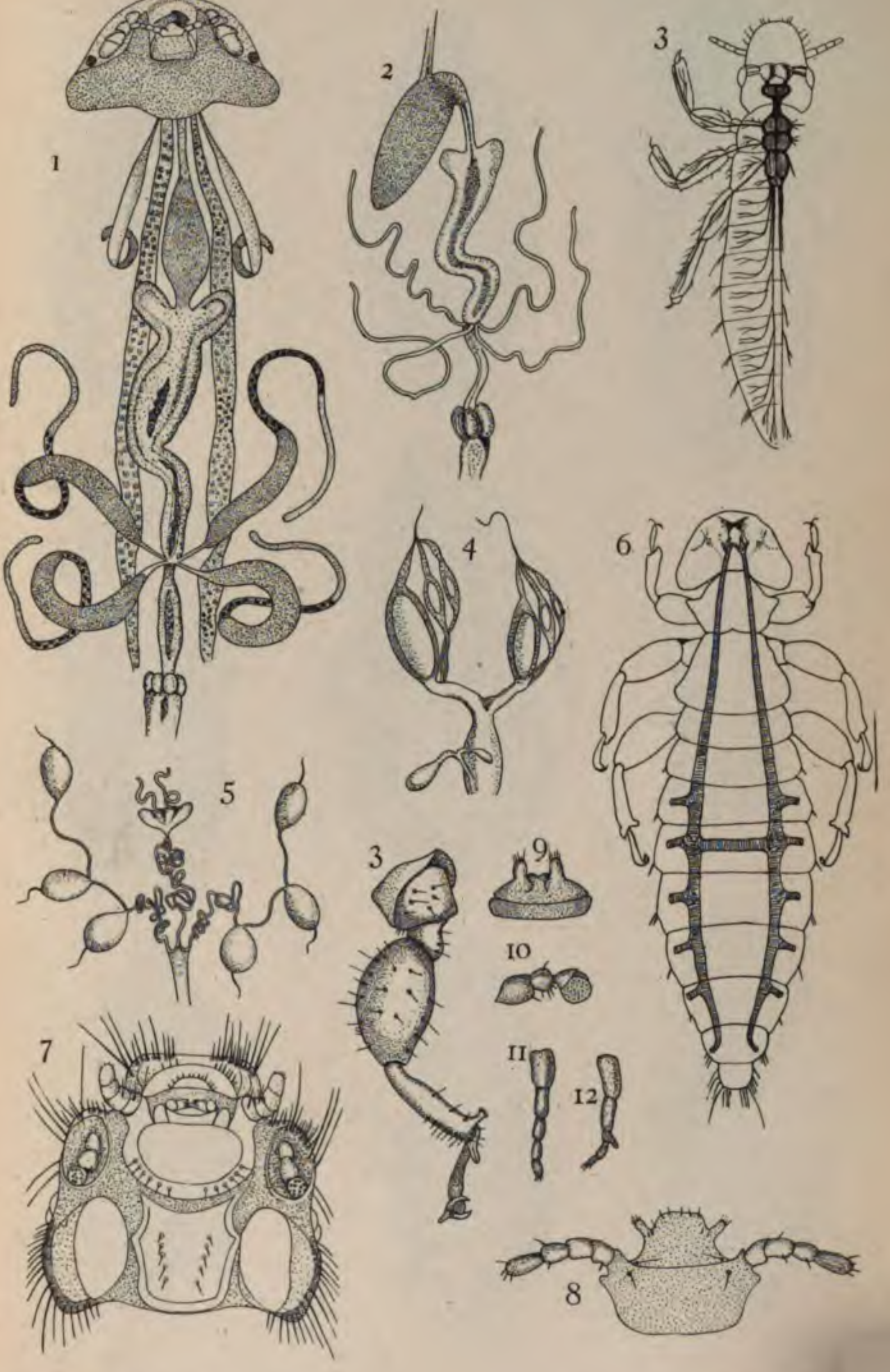
PLATE IX.—Fig. 1, *Lipeurus ferox* Giebel, ♀. Fig. 2, *L. ferox* Giebel, ♂. Fig. 3, *L. forficulatus* Nitzsch, ♀. Fig. 4, *L. forficulatus* Nitzsch, ♂. Fig. 5, *L. forficulatus* Nitzsch, juv. Fig. 6, *L. forficulatus* Nitzsch, very young.

PLATE X.—Fig. 1, *Lipeurus temporalis* Nitzsch, ♂. Fig. 2, *L. testaceous* Tschb., juv. Fig. 3, *L. toxoceros* Nitzsch, juv. Fig. 4, *L. testaceous* Tschb., ♀. Fig. 5, *L. toxoceros* Nitzsch, ♂. Fig. 6, *L. squalidus* Nitzsch, ♀. Fig. 7, *L. squalidus* Nitzsch, posterior margin of metathorax showing arrangement and character of hairs.

PLATE XI.—Fig. 1, *Oncophorus advena* Kell., ♀. Fig. 2, *O. advena* Kell., head of ♂. Fig. 3, *Eurymetopus taurus* Nitzsch, ♀. Fig. 4, *E. taurus* Nitzsch, head of ♂. Fig. 5, *E. taurus* Nitzsch, ♀ juv. Fig. 6, *E. taurus* Nitzsch, ♂. juv. Fig. 7, *Giebelia mirabilis* Kell., ♂. Fig. 8, *G. mirabilis* Kell., outline of head of ♀.

PLATE XII.—Fig. 1, *Colpocephalum unciferum* Kell., ♂. Fig. 2, *C. unciferum* Kell., outline and last segments of abdomen of ♀. Fig. 3, *C. unciferum* Kell., juv. Fig. 4, *C. uniforme* Kell., ♀. Fig. 5, *C. pingue* Kell., ♂. Fig. 6, *C. timidum* Kell., ♀. Fig. 7, *C. funebre* Kell., ♀. Fig. 8, *C. laticeps* Kell., ♂.

PLATE II.



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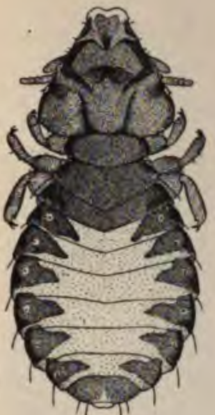
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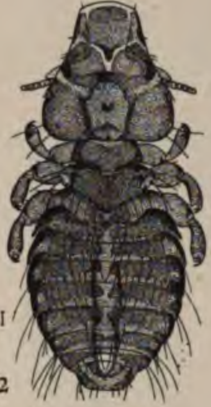
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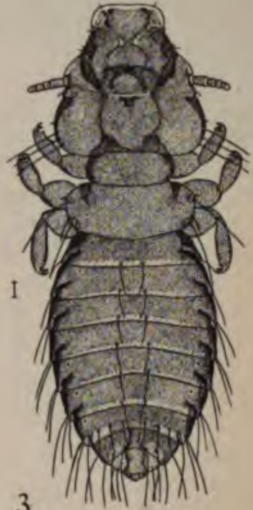
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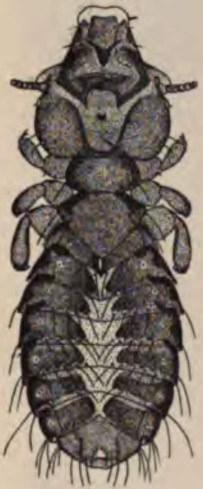
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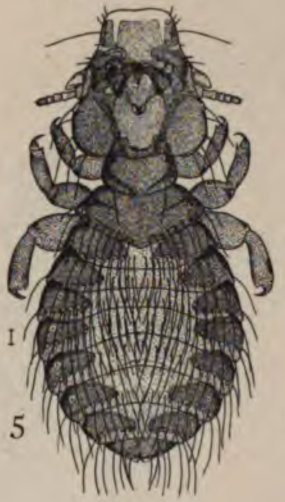
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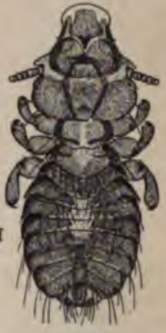
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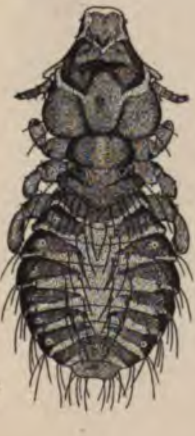
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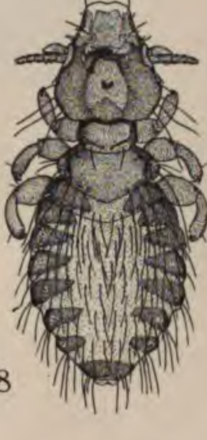
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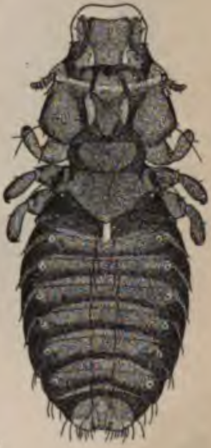
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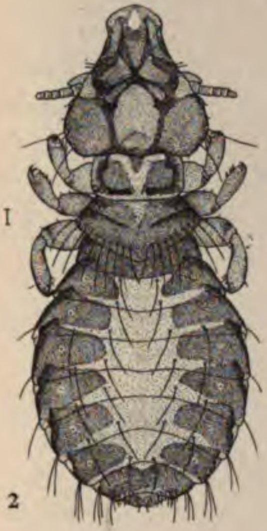

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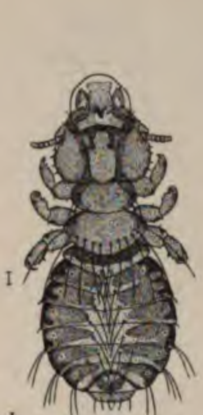

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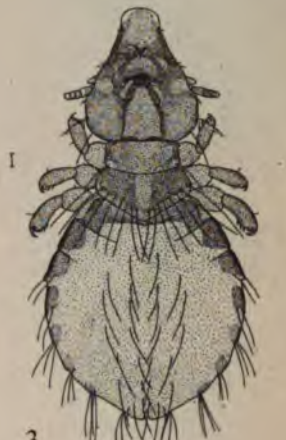

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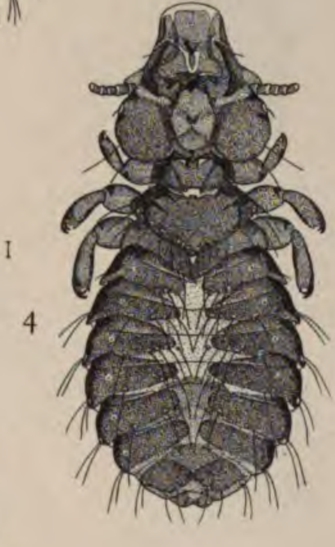

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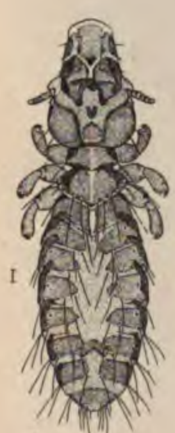

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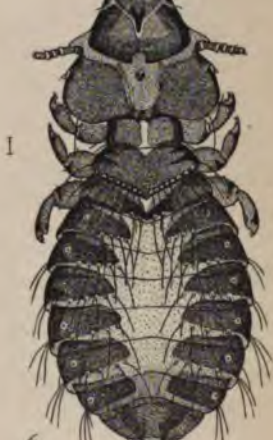

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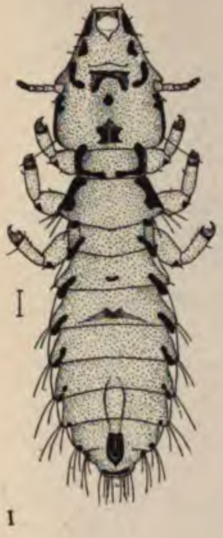
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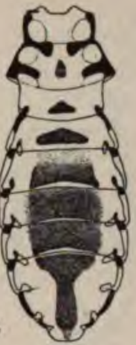
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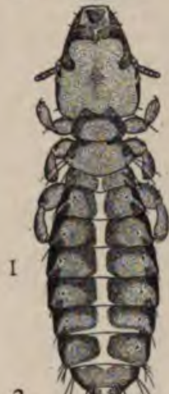
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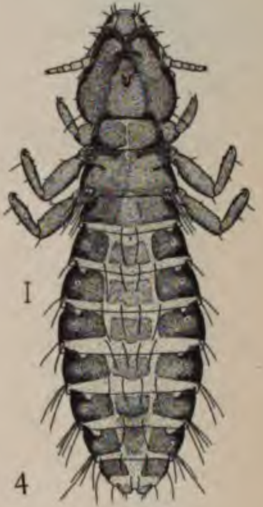
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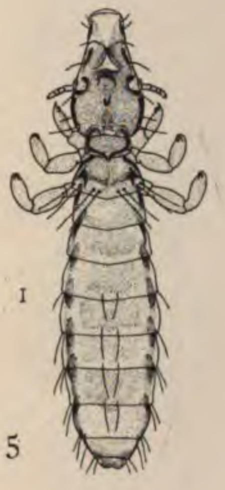
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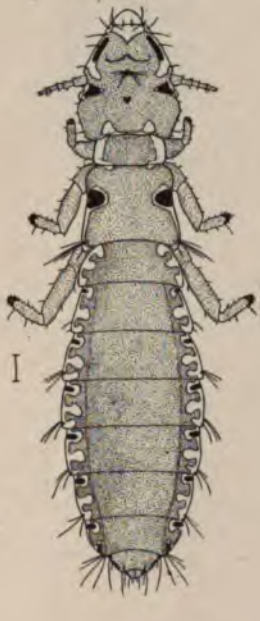
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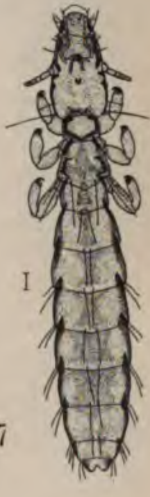
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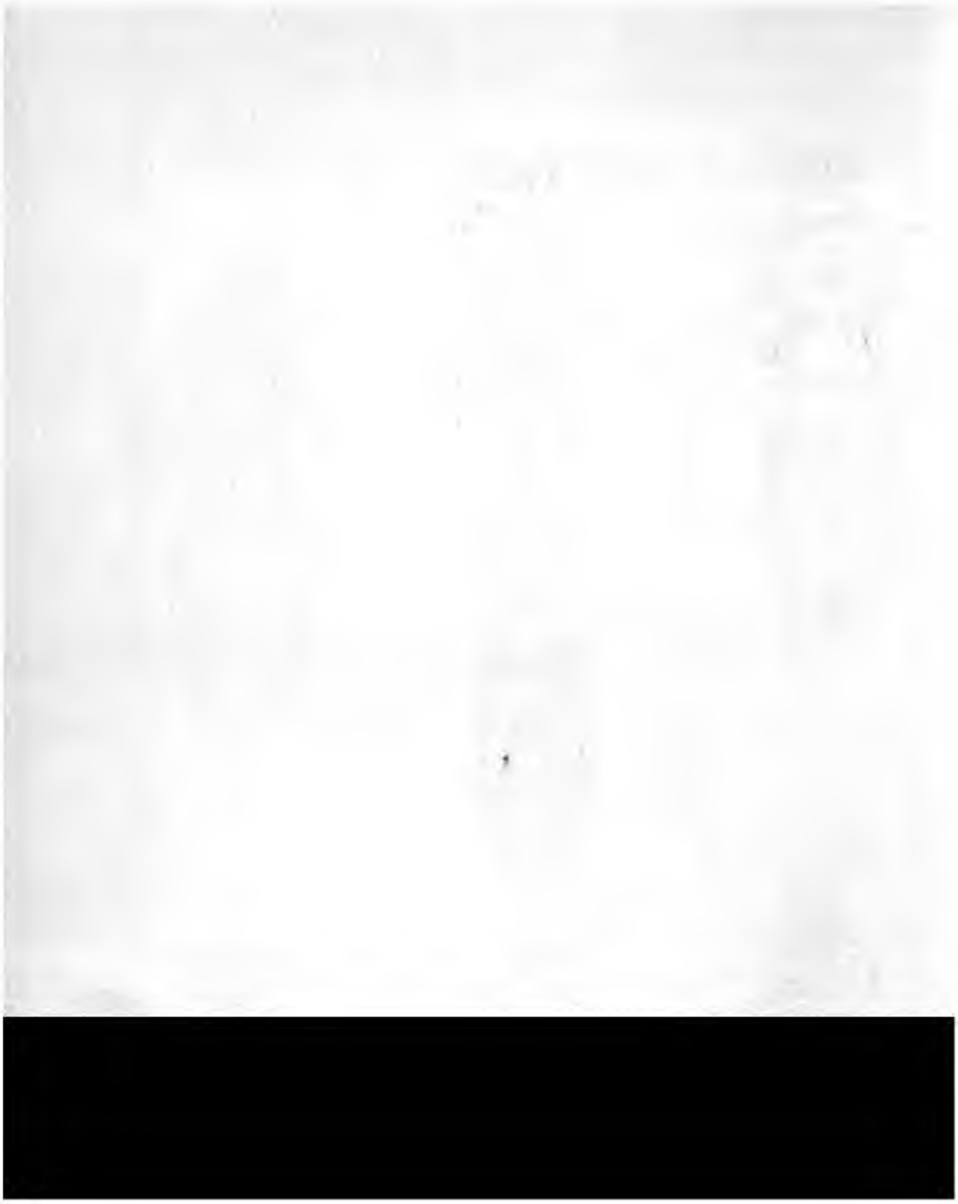

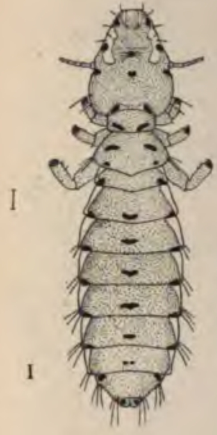

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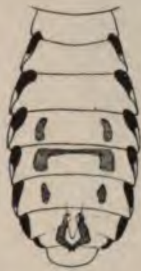

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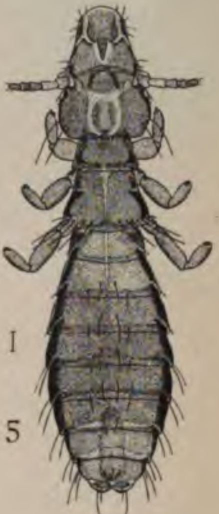

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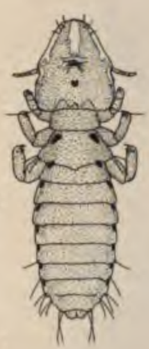

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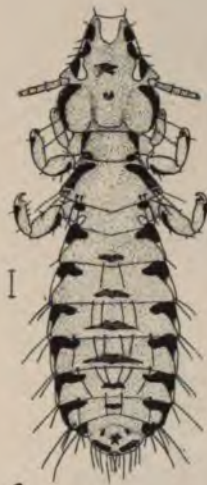

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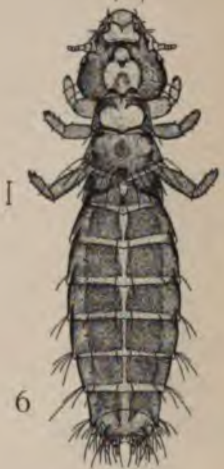

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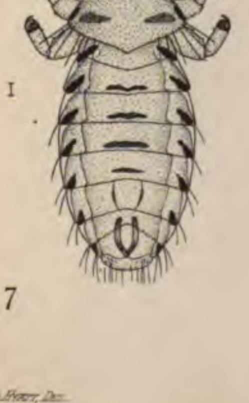

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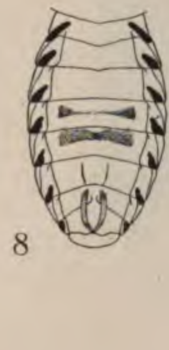

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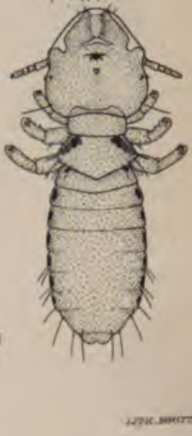

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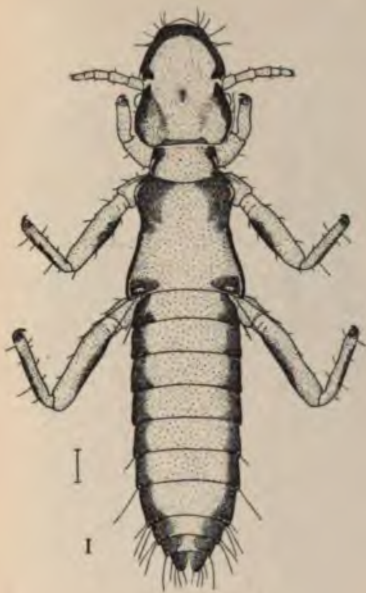
Lith. Britton & Rey, S.F.



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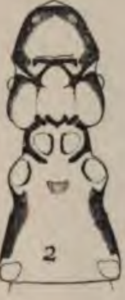

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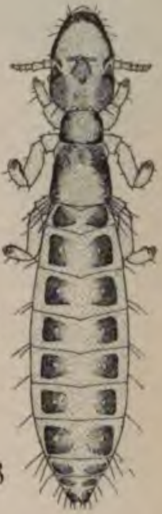

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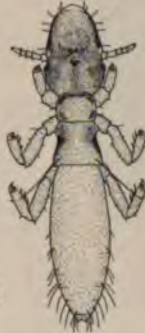

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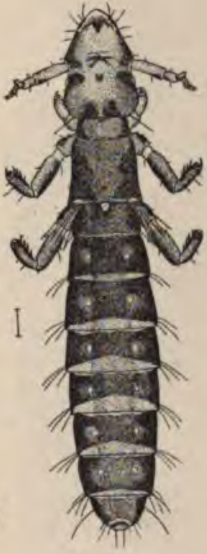

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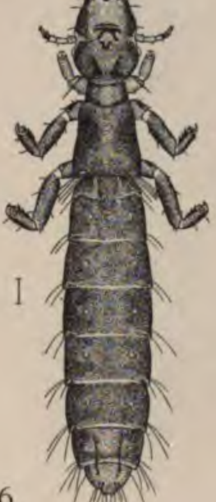

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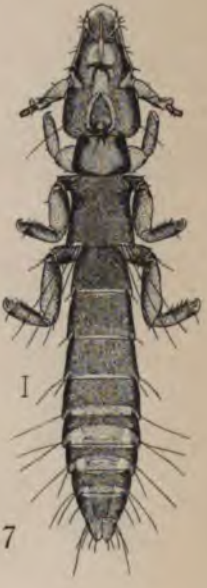

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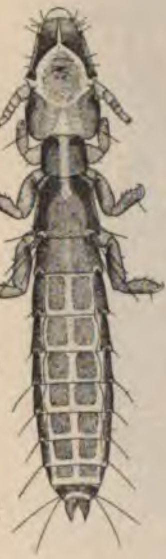
EDNA PRATT DEL.

LITH. BRITTON & REY, S.F.

PLATE VIII.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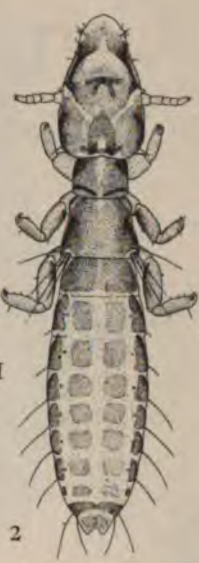
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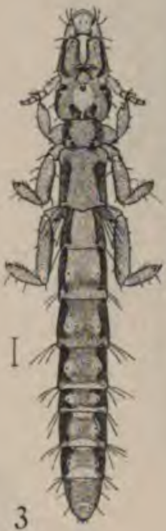
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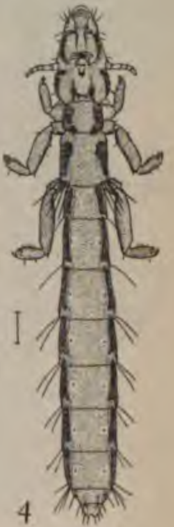
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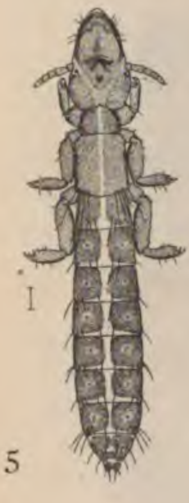
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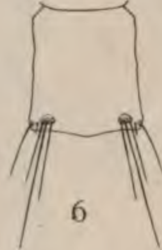
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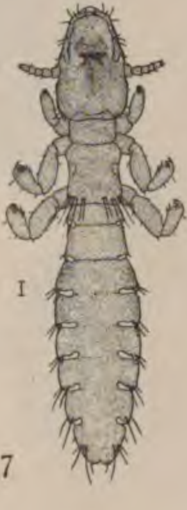
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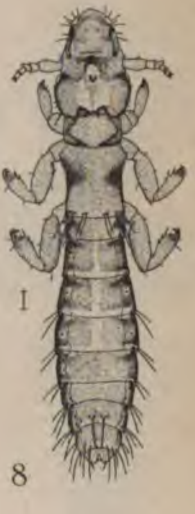
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EDNA HYATT, DEL.

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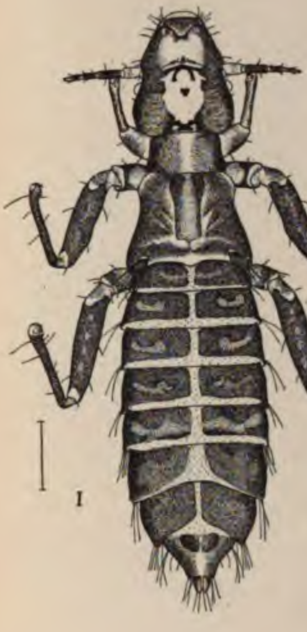
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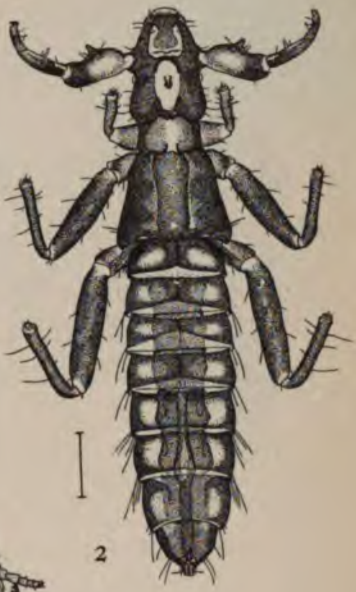
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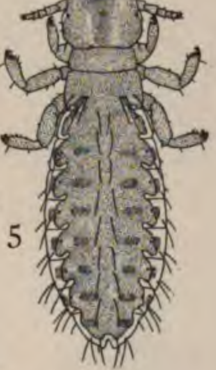
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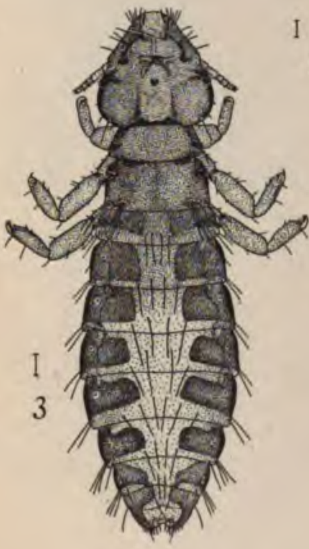
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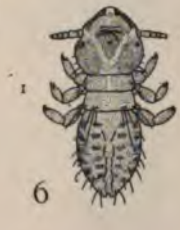
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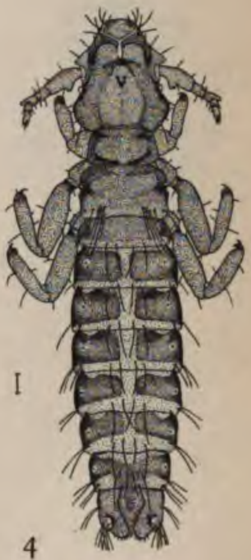
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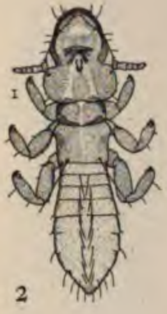

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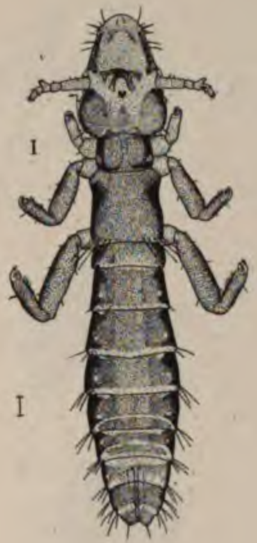

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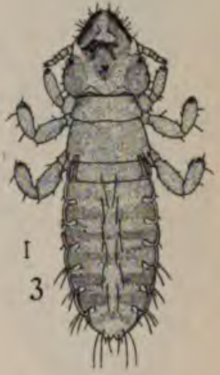

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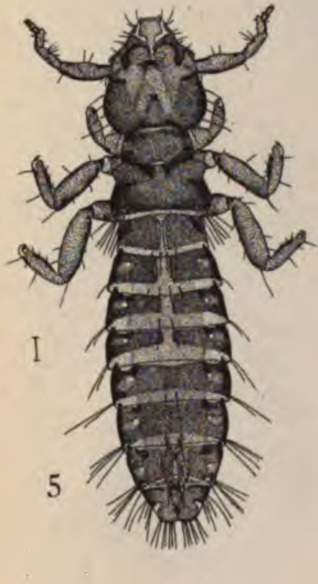

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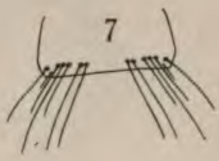

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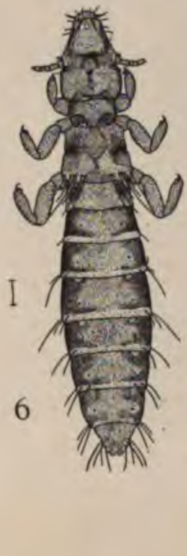

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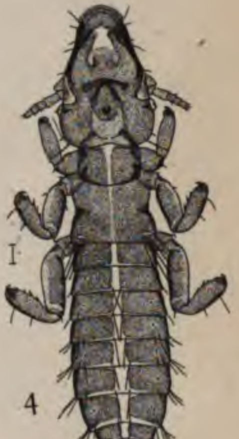

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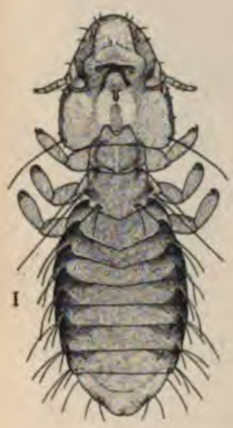

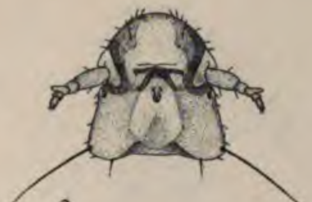
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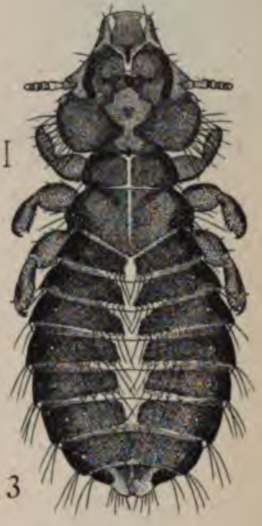
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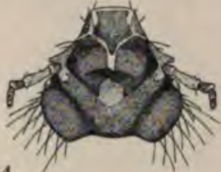
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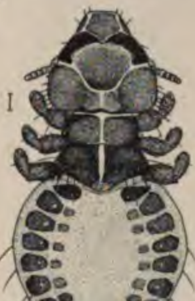
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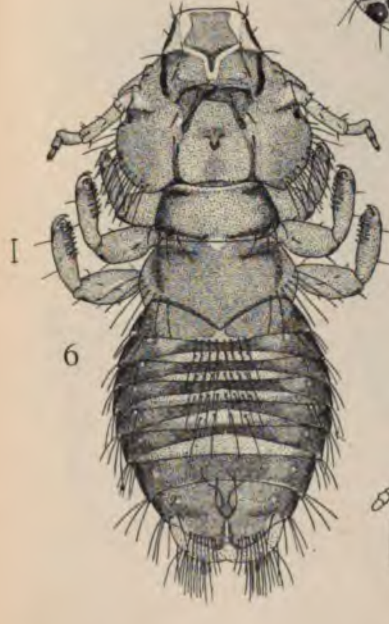
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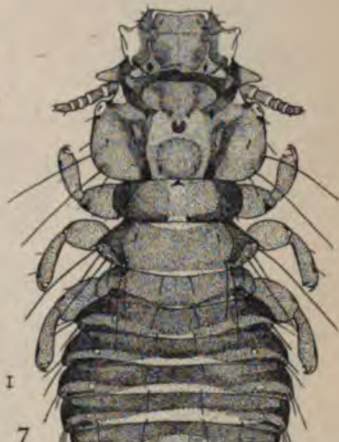
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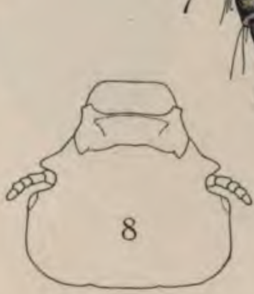
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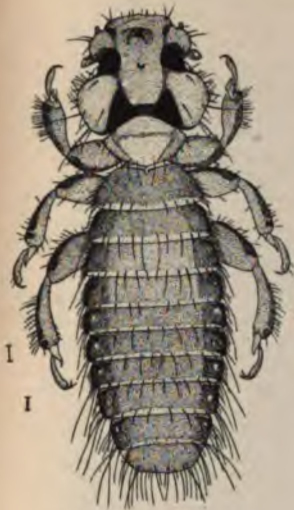

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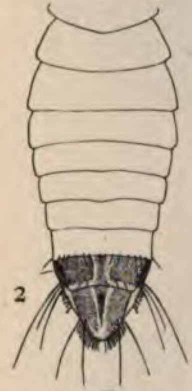

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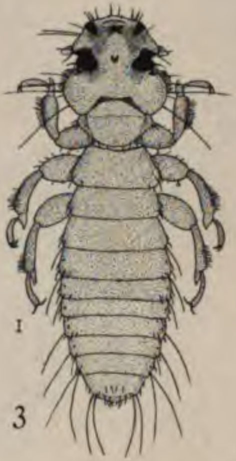

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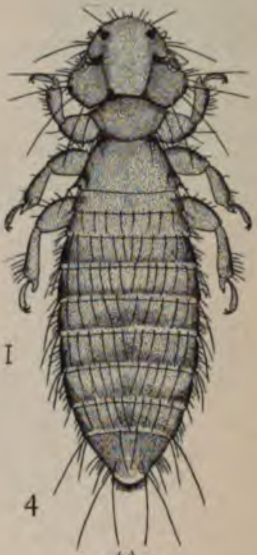

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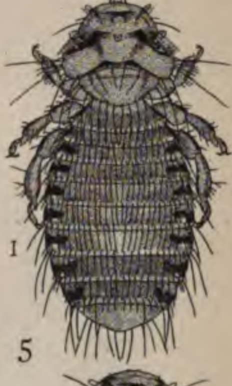

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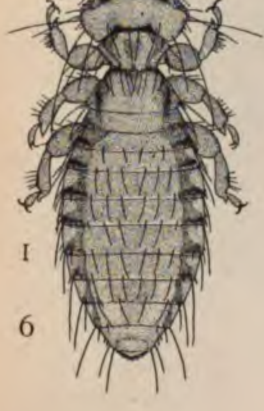

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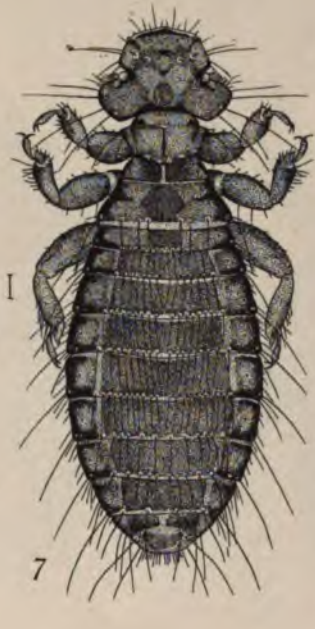

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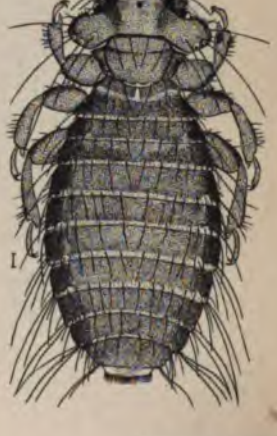

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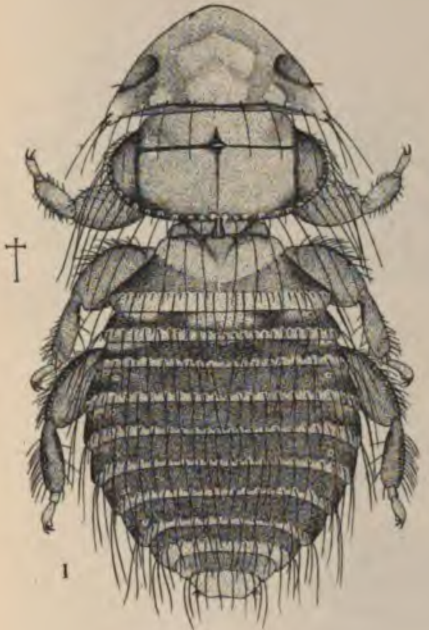
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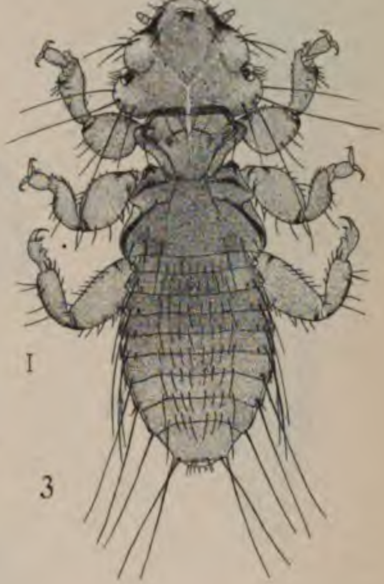
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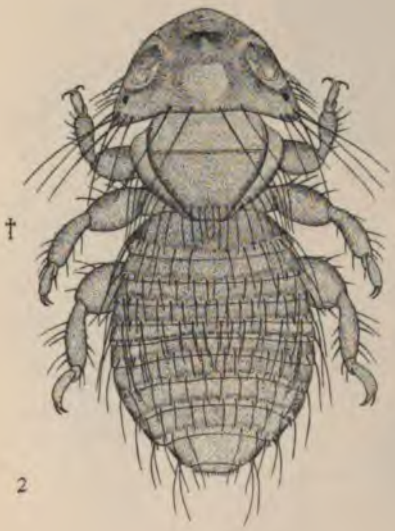
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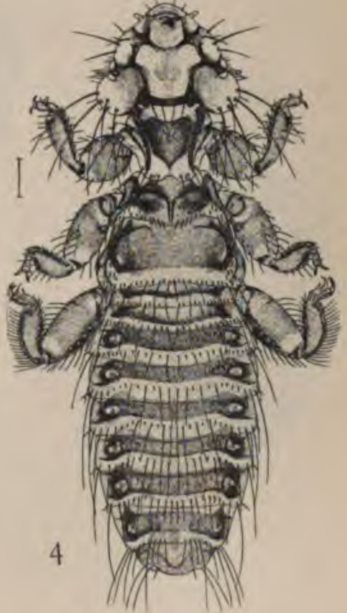
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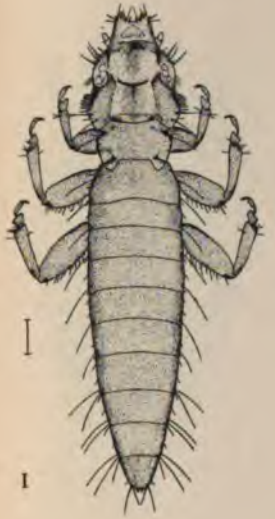
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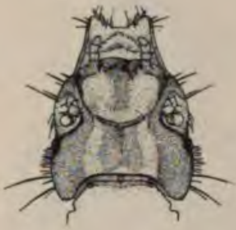
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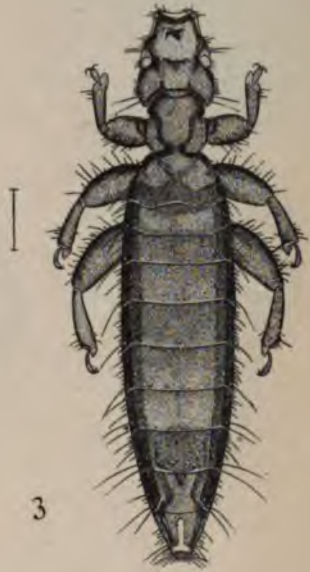
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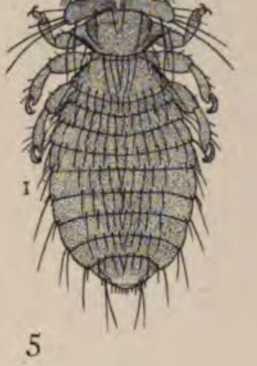
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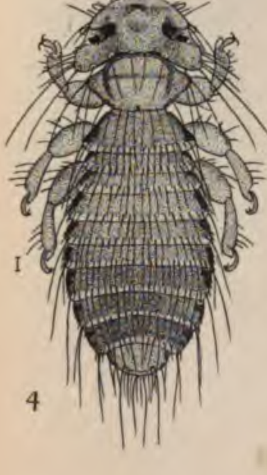
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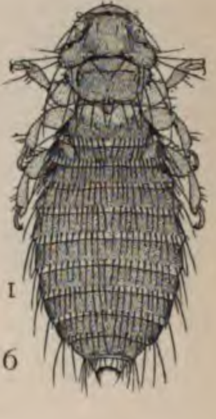
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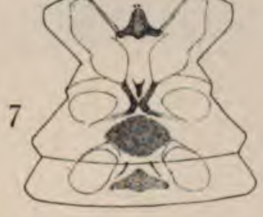
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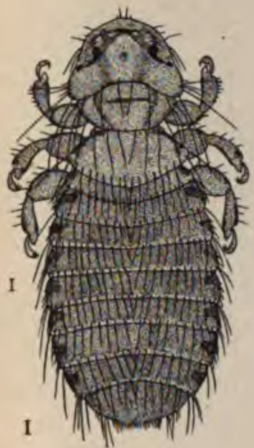

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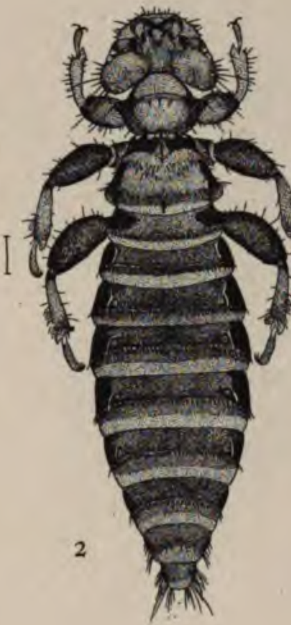

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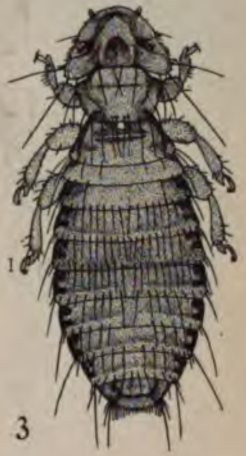

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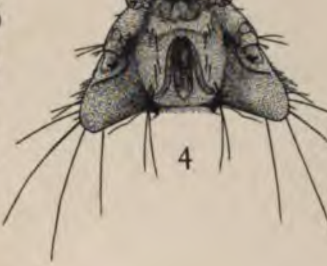

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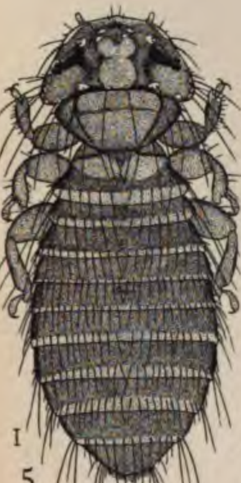

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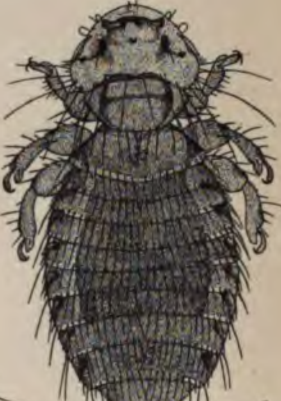

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EDNA HYATT DEL.

LITH. BRITTON & REY, S.F.

LELAND STANFORD JUNIOR UNIVERSITY PUBLICATIONS

CONTRIBUTIONS TO BIOLOGY
FROM
THE HOPKINS SEASIDE LABORATORY.
VII

# NEW MALLOPHAGA,

## II,

## FROM LAND BIRDS, TOGETHER WITH AN ACCOUNT OF THE MALLOPHAGOUS MOUTH-PARTS.

BY

VERNON L. KELLOGG,

*Professor of Entomology, Leland Stanford Jr. University.*

**(Reprint from the Proceedings of the California Academy of Sciences, Series 2, Vol. VI.)**

LELAND STANFORD JR. UNIVERSITY,
PALO ALTO, CALIFORNIA,
1896.

# PREFATORY NOTE.

This memoir is the seventh of a series designed to illustrate the investigations and explorations of the Hopkins Seaside Laboratory, an adjunct of the biological laboratories of the Leland Stanford Junior University. The series is issued under the patronage of Timothy Hopkins, Esq., of Menlo Park, California. The present paper is published with the co-operation of the California Academy of Sciences, appearing simultaneously in its present form and as part of the Proceedings of the Academy.

Charles H. Gilbert,
Oliver P. Jenkins,
Editors.

Date of publication, November 12, 1896.

# AUTHOR'S PREFACE.

The following paper presents the descriptions and figures of thirty-three new species of Mallophaga, together with the identifications and figures of sixteen species previously described by European authors, but now, with few exceptions, first determined as parasites of American birds. All of these species have been collected, mostly by the author and Mr. R. E. Snodgrass, from land birds as opposed to water or shore birds. (As No. iv, 1896, of this series of "Contributions to Biology from the Hopkins Seaside Laboratory," under the title "New Mallophaga, I......," the author published the descriptions and figures of one new genus and thirty-eight new species of Mallophaga, with the identifications and figures of twenty-two previously described species, all from water and shore birds. In New Mallophaga, I, was given a "brief account of the structure, external and internal, of the life-history and habits, and of the zoological and geographical distribution of the parasites, together with a review of the literature of the group, and a statement of the present systematic treatment of the order, with a synopsis and tables of the families and genera"; the paper is intended to serve American students as an introduction to the study of the group.)

In the present paper there is also presented a somewhat detailed account of the mouth parts of several genera of Mallophaga, and an account of the mouth parts of the Psocidæ, Perlidæ, Termitidæ, groups which have been variously classed with or close to the Mallophaga, sufficiently full to make an intelligent comparison of the mouth structures of these various groups possible. Some light seems to be thrown by this study on the phylogeny of the Mallophaga.

Types of the new species described will be placed in the collections of this University, in the collections of the California Academy of Sciences, and in those of the University of Kansas. The author has to express his obligations for services kindly rendered in connection with the preparation of this paper to Mr. F. J. Jack, artist, to Prof. Walter Miller, and to Mr. R. E. Snodgrass, who collected most of the specimens recorded from Californian birds, and whose careful work on the anatomy of the mouth parts is elsewhere more definitely referred to.

V. L. K.

STANFORD UNIVERSITY, September, 1896.

# NEW MALLOPHAGA, II,—FROM LAND BIRDS; TOGETHER WITH AN ACCOUNT OF THE MALLOPHAGOUS MOUTH-PARTS.

(With Plates lx-lxxiii.)

BY VERNON L. KELLOGG.

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## THE MOUTH-PARTS OF THE MALLOPHAGA.

The mouth-parts of the Mallophaga are of the biting Orthoptero-Neuropterous type; that is, they are of that generalized kind of insectean mouth-parts in which there are free, strong, laterally working mandibles, free jaw-like maxillæ composed of distinct basal sclerites, articulated terminal lobes and segmented palpi, and a labium composed of the fused second maxillæ with similar basal and terminal sclerites and segmented palpi. But the Mallophagous mouth-parts represent a modified, a specialized condition of this simple type, in which the reduction of the maxillæ with the complete loss of their palpi and (in one suborder) the loss of the labial palpi, so confuse, at first glance, the homologies of the various structures, as to make the proper understanding of the mouth-parts a matter requiring some special attention.

Nitzsch, the first student of the Mallophaga, misunderstood the structure of the mouth-parts, holding the labial palpi to be maxillary palpi (see figs. 1, 2 and 3, plate lx), and his error was not corrected until Grosse[*], in his careful dissections of *Tetraophthalmus chilensis* [=*Menopon titan*], made the matter plain.

[†] Rudow gives a most confused account of the mouth parts, having evidently made very superficial observation, although he declares himself to have made a most careful and exhaustive study of them. He concluded, from observation of the hypopharynx, that the Mallophaga should be classed with the sucking insects, and particularly with the Hemiptera. [‡] Melnikoff thought

sects. [*] Denny, [†] Giebel, [‡] Piaget and [§] Taschenberg add nothing in their monographs to our knowledge of the mouth-parts. Giebel repeats Nitzsch's explanation of them; Piaget refers the palpi of the Liotheidæ to the maxillæ, and also says the labium of the Philopteridæ has 2-segmented palpi, referring doubtless to the paraglossæ; Taschenberg in his passing reference to the mouth-parts repeats Piaget's statements. [‖] Grosse was the first to understand and to explain what seems really to be the true structure and homologies of the mouth-parts. He first indicated the labial character of the conspicuous palpi which are present in all of the Amblycera, called the labial palpar-like processes paraglossæ (see figs. 4 and 5, plate lx, *pg*), and gave some account of that sclerite in the œsophagus, which to my mind is so suggestive in its bearing on the phylogeny of the group. An abstract of Grosse's paper, by Prof. Geo. Macloskie, was published in the "American Naturalist," vol. xx, p. 340.

The following detailed accounts, with accompanying figures, of the mouth-parts of *Ancistrona gigas* P., *Læmobothirium* sp., *Eurymetopus taurus* N., and *Goniodes cervinicornis* G., are based on dissections made in my laboratory by Mr. R. E. Snodgrass, and are mostly in the words of his notes. The drawings also were made by Mr. Snodgrass.

---

[*] Denny, Henry. Monographia Anoplurorum Brittanniæ, 1842, London.

[†] Giebel, Christoph. Insecta Epizoa, 1874, Leipzig.

[‡] Piaget, E. Les Pédiculines, 1880; Supplement, 1885, Leyden.

[§] Taschenberg, O. Die Mallophagen, 1882, Halle.

[‖] Grosse, Franz. l. c.

## THE MOUTH-PARTS OF ANCISTRONA GIGAS.

(Plate lx, figs. 6-12.)

In this form the full number of mouth-parts is present, and all are complete except the maxillæ, these lacking palpi and distinct sclerites. The labium is well developed and much longer than wide. It extends along nearly the whole length of the ventral surface of the head, the anterior border being situated far forward, leaving only the tips of the mandibles visible. When the palpi are parallel to the plane of the head their extremities project a little beyond the anterior lateral margin.

The *labium* (plate lx, fig. 7) consists of three distinct parts, the ligula, mentum and submentum together with prominent palpi. The mentum is the largest sclerite and bears the four-jointed palpi. It is somewhat wider than long, and is incompletely divided into three lobes, one placed medially and the others on each side of this. The median portion has the anterior border straight or a little concave, and articulates with the ligula. Each lateral lobe is narrow and projects anteriorly beyond the median portion which is much wider. Each bears distally a palpus. The latter is composed of four short joints of about equal length.

dorsal prong is attached by its base to the mentum near the hind margin of the latter. From the posterior border of the mentum a deeply emarginated fold extends backward between the two forks, and is attached to the inner edge of the dorsal prong of each. In the young the emargination is much less, the fold being merely roundly concave posteriorly. In this stage it is attached for its full length along the median line to the submentum. In each fork the dorsal prong is rather flattened dorsoventrally; its outer edge is rounded inward proximally and outward distally, while the inner edge presents the same outlines, only in different order, so that the whole is doubly bent, first inwardly and then outwardly. The curvatures, however, are only slight, and the distal one is more marked than the other. The prong is much wider at its base than elsewhere, and tapers off very much distally. It ends by a triangular expansion, having one side of the triangle facing posteriorly and inwardly. At the base is an oval fossa, and in this the outer prong is articulated so as to allow of considerable movement. At the anterior outer corner of each fossa a large strong hair arises and extends outward and backward, being two-thirds or three-fourths the length of the fork. The ventral prong is more cylindrical than the other and tapers but little. It is almost straight, or slightly curved inwardly near the middle. Its base, however, curves dorsally, to be articulated with the other piece, as just described. It ends by a bluntly rounded termination which is very slightly expanded. Its dorsal surface is covered by numerous fine, closely arranged, rounded ridges. Proximally these lie almost longitudinal, but they gradually become more transverse, so that the terminal ones form an angle of about thirty degrees with a transverse line through their inner ends. The ridges meet each other along the median line of the prong at an increasing angle from in front backwards. The forks are less chitinized in young specimens, but very pale colored ones have them comparatively strongly chitinous, so that they appear very dark, while the rest of the outer parts are white.

The ligula is a short sclerite, divided into glossæ and paraglossæ. The glossæ are two rounded lobes, with a shallow concavity between them. They bear a few short hairs. External to the glossæ are the paraglossæ which are also two small simple lobes. They are separated from the glossæ a little more deeply than the latter are from each other, and like them are covered by a few small hairs.

The submentum is a simple sclerite back of the mentum, and mostly concealed by the forks and connecting fold from the latter.

The *maxillæ* (plate lx, fig. 8) are very weak, unchitinized structures, lying entirely within the mouth cavity, and concealed by the other mouth-parts on account of their very reduced size. Each consists of a basal undivided portion, somewhat roughly triangular in outline, and of two distal, soft fleshy lobes. The outer lobe is the larger of the two, and its inner edge lies ventral to

The *mandibles* (plate lx, figs. 6, 9 and 10) are large and strongly chitinized structures, and evidently perform an important part in the feeding habits of the insect. They are somewhat roughly triangular in profile, having each two points anteriorly and internally, opposing those of the mandible of the opposite side. They lie in a plane parallel to the head. The left one has its anterior surface smooth and a little convex. From the inner edge, a little back of the anterior angle, there projects inwardly and forward a short rounded process. Anterior to this and ventral to it the sharply terminated anterior angle of the mandible forms the second point or tooth. This one is very sharp compared with the other. The ventral surface is concave ventral to the posterior tooth and behind the anterior one. The latter is continuous down the ventral surface as a high wide ridge along the outer side. The posterior part of this surface is also elevated, and at the inner posterior angle is continued inward as a long and somewhat slender projection into the mouth cavity; this tapers distally, but terminates bluntly. At its base are two teeth projecting forward into the concavity on the ventral surface of the mandible just described.

The mandible is articulated to the head by a condyle and a facet. The condyle is on the posterior ventral edge, near, but some distance internal, to the outer posterior angle of the mandible. It is a rounded knot projecting backward. The facet is situated on the dorsal surface near the same angle of the mandible as the condyle. It, however, is not situated on the posterior edge, but somewhat further forward on the dorsal surface; but it lies in the same anteroposterior dorsoventral plane as the condyle. It faces posteriorly and outward, being situated on an elevation, and the cavity is rather shallow. The right mandible is a little smaller than the left but is otherwise very similar to it. There are the same two teeth, but the posterior one is a little thicker than on the left side. The concavity on the ventral side is not so extensive, and the projection from the inner posterior angle is shorter and thicker. The articulatory condyle is similar in position, but is perhaps a little larger. The facet, however, is relatively more external. In each mandible there is a considerable extent beyond a line drawn from the condyle to the facet, but this is much shorter than that in the opposite direction; i. e., inwardly. Each mandible is supported by two large chitinous processes (plate lx, fig. 9, *d. ch. r.* and *v. ch. r.)*, arising from a common thick base which is attached to both the ventral and the dorsal wall of the head. One of these processes lies ventral to the other, and, in the case of the right mandible, a little internal to it. The ventral projection bears terminally a socket and the dorsal one a condyle; these articulate respectively with the condyle and facet of the mandible. The mandible is thus supported on an axis above which is all its weight; and further, the greater part of the latter falls on the inner side of the axis when the mandibles are in the resting position. To the posterior edge of the mandible, near the inner angle but still some disrious in form, and whose functions are not definitely apparent, although they probably serve in some way for rasping or comminuting the food, or perhaps for holding it.

In the ventral wall of the pharynx is imbedded a chitinous rod or shaft, bearing two prongs at each end (plate lx, fig. 11, and fig. 6, *hy.*). The shaft is rather long and slender, with a swelling posterior to the middle. The posterior prongs are curved outward and backward, and also a little upward around the œsophagus. Their bases are very wide but they soon become narrower. Terminally each is somewhat expanded and ends bluntly. The anterior half of the wide basal portions is much thinner than the rest, and the shaft appears between the two as a wide elevated ridge, continuous with the posterior thickened borders. A large oval foramen, having its long axis extending from within outwardly and posteriorly, is situated between the thin part, the thickened shaft, and the posterior elevated margin. The anterior fork projects into the mouth, dorsal to the anterior end of the labium, in the position of a hypopharynx. The prongs of this bifurcation are much smaller than those of the other and project outward and forward. The entire length of the structure in a specimen measured is .52 mm. The part projecting is about a fifth of the whole. All but this latter part is imbedded in the ventral wall of the pharynx and is not visible from above. It is evident that it must be developed from an invaginated portion of the cuticle which became strongly chitinized and constricted off from that lining the mouth. The two anterior prongs have on their anterior edges each a padlike, soft, unchitinized structure. Each pad is distally surmounted on the dorsal surface by a large cluster of rather long, thick, curved processes, radiating from a common center and curving upwards.

All have their concave borders facing one another and the center from which they spring. Along the convex surface of each is a fringe of cilia inclined distally. The rest of the pad is covered by short, thick projections, lying with their long axes parallel to the surface and curving over to the dorsal side, where they become scale-like in form. Between this hypopharynx and the labium is a fold of membrane from which project the anterior ends of two other structures. There are two chitinous rods (plate lx, figs. 6, *fk*, and 12) whose anterior forked ends project through this fold and lie beneath and a little external to the hypopharynx. They may be exposed by removing the labium. Each lies ventral to all the other organs in the head. Posteriorly they diverge from each other and pass backward, ventral to the lower edge of the tentorium, and are attached to the ventral wall of the head by muscles. They are very slender and delicate on account of their thinness and being not very strongly chitinized. Anteriorly each is rather expanded and flattened dorsoventrally, but posteriorly becomes narrower and more cylindrical. The outer prong of the anterior bifurcation is wide and thin, the other is longer, narrower, a little curved outwardly, and rather

## THE MOUTH-PARTS OF LÆMOBOTHRIUM SP.

(Plate lxi, figs. 1-5.)

The *labium* of *Læmobothrium* sp. (plate lxi, figs. 1 and 4) consists of submentum, mentum, palpi, and ligula. The labium as a whole occupies two-thirds of the length of the ventral surface of the head. Its anterior border lies in front of the bases of the antennæ, and extends also considerably farther forward than the bases of the mandibles; hence the latter are almost concealed by the labium.

The submentum (plate lxi, fig. 4, *sm.*) is a transversely narrowed sclerite very convexly rounded posteriorly, and slightly concavely rounded laterally where it joins the temporal sclerites. The anterior border is more decidedly concave and articulates with the convex posterior border of the mentum. The submentum is a little wider than half its length, and on the whole is somewhat narrowly shield-shaped. In front of the submentum is the mentum (plate lxi, fig. 4, *m*). This sclerite is wider than long and is somewhat oval in outline, with the long axis transverse; the latter is a little in front of the middle point. The lateral and posterior borders are very convex, and the sclerite may also be regarded as being an isosceles triangle with the angles very much rounded, and the apex pointing backward. Laterally there are two short thick, anterior prolongations, *pf*, one on each side. These bear the short four-jointed labial palpi. Each segment of the palpus is rather short and cylindrical and bears a few hairs. The terminal one is shorter than the others and forms a rounded termination to the palpus. The ventral surface of the mentum is produced downward into a large saccular or pouchlike distention which is almost as wide and long through its greatest diameters as the mentum itself. Where the pouch joins the mentum, however, it is narrower than it is a short distance below; it therefore expands a little ventral to its dorsal border. In a mounted specimen the pouch may be pressed down flat against the rest of the labium, and then its anterior border appears to be a fold of membrane extending over the ventral surface of the ligula from the anterior edge of the mentum. Within this pouch are two large glands (plate lxi, fig. 5) lying side by side, one on each side of the median line. They are narrower anteriorly where they open into the mouth cavity near the anterior edge of the labium. Posteriorly they become enlarged and turn outward.

The ligula is composed of glossæ and paraglossæ. The glossæ are flattened lobes, one on each side of the middle line, and separated from each other for about two-thirds their length. Each is about as wide as long, and the anterior border slopes slightly outward from within. The outer borders are straight. The paraglossæ lie just exterior to the glossæ. Each is conical with the end truncated, and is a little longer than the glossæ.

The *maxillæ* (plate lxi, figs. 1, *mx*, and 3) are simple lobes expanded distally but narrow at the base. Each projects inwardly and forward, and lies just back of the mandibles ginal thickening and perpendicular to it, the latter lying close to the edge, just back of the teeth. Near the base of the maxilla on the inner side is attached a large muscle, as large as the maxilla itself. This large muscle and the strong teeth seem to indicate that the maxilla is not functionless, but that it plays some part in the mastication of the food.

The *mandibles* (plate lxi, fig. 2) are the same in general shape and position as those of *Ancistrona gigas*. Those of the two forms present corresponding processes, and in each they lie in a plane parallel with the head. They are in both triangular in general outline viewed dorsoventrally.

The right mandible of *Læmobothrium* has at its anterior inner corner a large, strongly chitinized tooth, which is a continuation inward and forward from the ventral surface of a strong anterior thickening of the mandible. Posterior to this is a second tooth, just as in *Ancistrona*, continuous with the dorsal surface. This, however, instead of being regularly rounded is in *Læmobothrium* very wide, especially at the base, and is of the form of a truncated cone. The inner, or free end, is roughened by several short blunt cusps. This tooth, however, very evidently is the same thing as the posterior tooth of *Ancistrona;* the positions on the mandibles are identical.

From the inner posterior angle is a thick blunted process extending inward. It is rather short and terminally rounded. This process is present also in *Ancistrona gigas*. The outer posterior angle is truncated, and at its inner corner, projecting from the ventral surface, is an articulating condyle. This is some distance from the outer corner, and to the latter is attached the extensor muscle. The condyle projects backward and a little outward, and fits into a socket of the head. Dorsal to this on the head is a condyle which articulates with a facet on the dorsal side of the mandible. This facet is more external than the condyle of the mandible, and is also farther forward. In all these points the mandible is extremely similar to the corresponding one of *Ancistrona*. The retractor muscle is attached directly near the inner posterior angle.

The left mandible is in general similar to the right, and agrees with the corresponding mandible of *Ancistrona* in the same way as the right one does, although the two are rather less alike than those of *Ancistrona gigas*.

The posterior tooth of the left mandible is continuous from the dorsal surface, but is very small compared with the anterior one, and is sharp-pointed compared with the corresponding tooth on the right side. The anterior tooth is much the same as that on the right side, or is perhaps a little smaller. Back of it is a depression on the inner part of the ventral surface: this is bounded behind by an elevation which is continuous inwardly as a slender projection from the ventral surface, just as in the case of *Ancistrona gigas*. This process is thick at its base but tapers distally to the rounded termination. Its anterior border is convex, but on the distal half of the posterior margin is a rather deep, rounded concavity. To the outer

## THE MOUTH-PARTS OF EURYMETOPUS TAURUS.

(Plate lxii, figs. 1-8.)

There are many striking differences between the mouth-parts of this form and those of either *Ancistrona* or *Læmobothrium.* The dissimilarity is most noticeable in the labiums. *Ancistrona* and *Læmobothrium* both belong to the suborder Amblycera, while *Eurymetopus* and the next form to be described, *Goniodes,* belong to the sub-order Ischnocera, and the differences presented by these four genera are typical for the two groups.

In *Eurymetopus taurus* the *labium* (plate lxii, figs. 1 and 6) is reduced in size, and very much crowded back on the posterior aspect of the head. Instead of covering over the mandibles ventrally, it leaves them entirely exposed, its anterior border reaching only about as far forward as their posterior articulations.

On the posterior half of the median ventral surface of the head is a large unchitinized space. This is bounded laterally by the temples, posteriorly by a narrow, gular sclerite, presenting an obtusely angulated, convex, anterior border, and anteriorly in appearance by the mandibles, although it is really not bounded at all in front. The area is somewhat heart-shaped, having the apex forward, for the boundaries formed by the temples are convergent forward.

The membranous labium stretches across the posterior half of this space, while the part in front of the labium forms the mouth-opening. The labium is composed of the full number of sclerites, and of these the submentum is the largest. It is much wider than long; is unchitinized and membranous, and is attached all around, except in front, to the edges of the space just described. Its lateral edges are convex and rounded, while the posterior border is angularly emarginated to receive the convex margin of the gula. Its posterior angles are much rounded. Anteriorly it presents a concave border of which the lateral portions are free, but the median part bears the mentum. The submentum, on account of its anterior and posterior concavities, is much constricted in the middle.

The mentum is a comparatively narrow, tranversely elongated, unchitinized sclerite, attached posteriorly to the submentum, but having its lateral borders free. The anterior outer angles are rounded. The median portion of the anterior border bears the glossæ and paraglossæ. These are not separated by any suture from the mentum, and hence there is no distinct ligular sclerite. The glossæ are two small oval lobes situated on each side of the median line and close to each other, being only slightly separated. Each bears four or five large, strong hairs situated on small basal segments. External to each glossa is a rather deep fossa in the mentum. In these fossæ are situated the paraglossæ. These are cylindrical structures having the outer ends somewhat enlarged, and bearing six or seven large, strong, two-jointed hairs like those on the glossæ. The paraglossæ are rather strongly chitinized compared with the rest of the labium;

The *maxillæ* (plate lxii, fig. 4) are simple, fleshy, unchitinized lobes attached to the lateral parts of the mouth-cavity, back of the mandibles. They show no indication of division into different sclerites. Near their bases they are somewhat thickened; the distal ends are weak and almost membranous, in mounted specimens they generally appear twisted and distorted. On account of the position of the labium the maxillæ are mostly exposed, only the bases being concealed. Each projects forward and inward.

The *mandibles* (plate lxii, figs 1 and 5) present a very strange appearance, both on account of their shape and their position. They are large, heavy, and strongly chitinized, and very remarkably different from those of *Ancistrona* and *Læmobothrium* in the way they are attached to the head. In these two genera the mandibles lie in a plane parallel to the head, and move in this plane. In order that this may be so, their articulating surfaces are in the same or nearly the same dorsoventral line. In *Eurymetopus taurus* there are two articulating surfaces as before, but the mandibles move in a plane which forms a large angle with the horizontal plane of the head. To accommodate this action the articulating surfaces lie one in front of the other. The plane of the mandible is, however, not at right angles to that of the head, and consequently the anterior articulation is a little dorsal to the posterior one. In the next form to be described, *Goniodes cervinicornis*, the mandibles are almost or quite at right angles to the head, thus presenting an advance in this respect beyond *Eurymetopus*. In either of these two genera the mandibles may be regarded as being the same, typically, as in the Amblycera; but that each has been revolved on an axis passing from the tip of the inner basal process to the articulating condyle, until the anterior margin becomes the ventral margin. All the apparent differences may be reconciled by this view. In accordance with it the articulating surfaces lie as they should. Further, the mandibles being as in the other genera, two-toothed, the posterior rounded tooth of *Ancistrona*, arising from the inner dorsal margin, lies in this form on the anterior inner aspect, in front of, and dorsal to the larger tooth.

The left mandible has also the long slender process at the inner part of the base, as in *Ancistrona* and *Læmobothrium;* but, as would be expected, this arises from the dorsal aspect of the base. Since, however, in *Eurymetopus* it is very long and slender, it is bent backwards so as to lie parallel with the head. In *Goniodes cervinicornis*, however, it is shorter and projects inwardly.

The mandibles of *Eurymetopus taurus* are entirely exposed on the ventral surface of the head, not even their bases being covered by the labium. They are thick and have a clumsy appearance. The anterior articulating surface is a large facet situated at the anterior outer angle of the mandibles, on the dorsal surface. A rounded process projects over it from below. The posterior outer part of the mandible, bearing the condyle by which it is tooth is shorter than the other, not so thick, and has a rounded termination. Its anterior border is just visible from the ventral side of the head, in front of that of the ventral tooth.

In *Eurymetopus* and in a large number of other genera of the Mallophaga there occurs a very curious pharyngeal sclerite with accessory structures, within the cavity of the head. It is not intended here to explain the origin or function of these, but merely to describe them.

The sclerite referred to is a thick, strongly chitinous structure situated in the ventral wall of the pharynx, and is probably a greatly modified portion of its chitinous cuticle. In a mounted specimen it is plainly visible through the head from either the upper or the lower side. Lying ventral to the sclerite are two structures which appear to be glands, and are connected with it by a duct. All three of these structures are visible through the head of cleared and mounted specimens, and lie just back of the anterior edge of the labium.

This *œsophageal sclerite* (plate lxii, figs. 1, 2, 3 and 7) is in general form cup-shaped, having the hollow part turned upward and forming a depression in the floor of the pharynx, since its interior is simply a part of the pharyngeal cavity. The ventral surface is very convex, being almost hemispherical. The anterior end is truncated, but from each of the two anterior angles thus formed there projects forward, outward, and dorsally, a large dorso-ventro-laterally flattened process, which lies in the lateral wall of the pharynx, the two partly surrounding the cavity of the latter. Each of these processes is expanded distally, and sends a long, rounded, and bluntly terminated projection backwards. These latter processes lie parallel with and a little external to the lateral margins of the body of the sclerite, their outer edges being visible from the ventral side. Posteriorly there is a thick, rounded, median process which projects backward from near the dorsal edge of the sclerite, but still some distance below it, so that it is free from and not imbedded within the wall of the pharynx.

The sclerite, viewed ventrally, is somewhat shield-shaped in profile. The body is almost semicircular, with a small segment taken off in front by the anterior truncation referred to. Posteriorly there projects the median rounded process, and anteriorly on each side the anterior lateral processes. The latter give to the anterior profile an emarginated appearance. In the middle there is a longitudinal light colored area, due to the cavity on the dorsal side, the floor of which, being thinner than the other parts, transmits more light in mounted specimens. This area is expanded near the front, contracted from side to side posteriorly, and rounded before and behind. Along the median line there is a narrow linear area still lighter in color, due to a groove in the bottom of the dorsal hollow.

The dorsal surface of the sclerite is, as already described, excavated, and is doubly so, there being one cavity situated within another. The upper of these is a noticeable on the sclerite when viewed from the ventral side by means of transmitted light. It is much longer than broad, and its widest diameter is in front of the middle. Anterior to this the dorsal edges form a rounded outline, but back of it they are a little concave and approach each other posteriorly. The posterior end is narrow and rounded. The walls of the cavity are concave, steeper in front and behind than elsewhere. The bottom slopes a little downward posteriorly, so that the cavity is deepest behind. Running longitudinally along the bottom is a narrow groove; this begins in front at the bottom of the anterior wall, and extends backwards from an aperture which is the opening of a duct into the sclerite.

To the sides of the shallower cavity are attached two large, laterally compressed, chitinous, pyramidal structures, one on each side, whose ventral surfaces are not quite so divergent as the walls of the cavity to which they are attached, or perhaps better, from which they arise. The bases of these are very wide, but dorsally they become rapidly narrowed and pass upwards around the œsophagus, or pharynx, as two chitinous bands. Their dorsal ends are attached by large muscles to the dorsal wall of the head.

The sclerite is about as wide as long, or sometimes a little longer. The dimensions of one specimen measured are as follows: Length of the body, .097 mm.; width, .108 mm.; length of posterior projections, .02 mm.; distance which anterior processes extend in front of anterior border of the main part or body, .0227 mm.

The gland-like structures (plate lxii, figs. 1, 7 and 8) before referred to, lie ventral to the sclerite, and the inner halves overlap its outer portions (fig. 7). Their outer edges also lie a little dorsal to their inner edges, so that they extend slightly around the outer margins of the sclerite. Each is an oval structure, having the long diameter extending from within outwards and backwards. The ventral surface is convex, and the dorsal surface concave, while the whole is very much flattened dorsoventrally. Each is invested in a thin chitinous envelope, and is seated upon the ventral anterior surface of a chitinous pedicle which is expanded where it receives the gland. The expanded portion of the pedicle is thin and convex ventrally, so as to fit the dorsal concavity of the gland; and the middle of its shallow dorsal concavity lies below and external to the outer edge of the sclerite. Back of the glands the pedicle extends backward and outward, but not so much in the latter direction as the long axis of the gland, so that the two form an obtuse angle inwardly. The part of the pedicle not having the gland attached is about as long as the other part, and it is somewhat more chitinous. It tapers backward, but ends in a foot-shaped expansion, with the toe turned outward. To this is attached a large, wide muscle which extends backward to its origin in the posterior part of the head cavity. At the posterior end of the gland, on the ventral surface, a duct arises which passes forward, attached closely to the gland, to its anterior end; here it leaves the gland and continues forward, but soon turns inwardly and dorsally, and then posteriorly, meeting and fusing with the duct from the gland of the other side. This common duct then runs backward to the sclerite, which it enters as already described. The relative positions of the glands and sclerite vary somewhat, since they are evidently movable structures, judging from the attached muscles, and hence, also, the duct varies in position; but all such changes are slight. The free portion of the duct consists of an inner chitinous tube continuous with that soldered to the glands, but in addition to this there is an outer portion composed of a series of closely set, chitinous rings, surrounding the tube. Each gland is about as wide as the sclerite, but is considerably longer.

## THE MOUTH-PARTS OF GONIODES CERVINICORNIS.

(Plate lxi, figs. 6-9.)

In *Goniodes cervinicornis* as in *Eurymetopus taurus* the mouth-parts are crowded far back on the ventral surface of the head, so that the bases of the mandibles lie posterior to the bases of the antennæ, instead of in front of them, as in most of the Amblycera.

The *labium* (plate lxi, fig. 7) has its anterior border between the bases of the antennæ, and hence it is very much shortened from before, back. The part which seems to have suffered most in the crowding is the mentum. It is narrow and not distinctly separated from the ligula, and is farther aborted by having lost its palpi. This condition is true not only in the genera *Eurymetopus* and *Goniodes*, but holds for the Ischnocera generally.

The main sclerite of the labium is the submentum. This is a large unchitinized sclerite, having a straight posterior border and a very concave anterior border. The sides present an obtusely angulated, convex margin. The anterior border is so deeply and roundly concave that it forms almost a semicircle. Its most posterior part is as far back as the middle of the lateral edge of the sclerite; hence there is a narrow portion projecting forward on each side. These reach as far anteriorly as a line joining the middle of the bases of the antennæ. The rest of the labium is situated in the concavity of the anterior part of the submentum. It consists of the fused mentum and ligula (plate lxi, fig. 7), and is divided into three lobes, two lateral and one median. The median lobe is almost square, and has its anterior border slightly emarginated and the anterior outer angles projecting a little. This lobe is thus composed of the glossæ, which are separated only by the anterior emargination. The lateral lobes are rounded and bear the cylindrical paraglossæ. These are almost identical with the paraglossæ of *Eurymetopus*, being also more strongly chitinized than the rest of the labium, and bearing on their slightly expanded ends a few strong hairs with basal segments. They project ventrally and a little inward and forward, the distal ends being nearly always seen first on focussing down on a specimen toward the ventral surface.

Back of the submentum is a narrow gular sclerite continuous across the median line from the lateral portions of the head.

The *maxillæ* (plate lxi, fig. 6) are soft unchitinized structures lying within the mouth cavity. Each is divided into three lobes: one basal, another terminal, and the other between these two. By the basal lobe the maxilla is attached to the wall of the head, and it projects inward into the mouth cavity. It is irregularly round in outline and is entirely unchitinized. The middle lobe is of about the same size as the first, and is joined to the latter by a plane almost perpendicular to it, but inclined very slightly forward; their tips meet in the middle line, so that they form an arch over or ventral to the mouth-opening. The anterior lateral projections of the submentum extend forward beyond the bases of the mandibles, and the glossæ and paraglossæ lie just back of their posterior margins. Hence the mentum, ligula and mandibles are all enclosed in the anterior semicircular border of the submentum.

The right mandible is triangular in dorsoventral section. The ventral part is thickened and prolonged inwardly at the inner ventral angle, forming two large thick, bluntly pointed teeth. These are separated from each other only by a slight emargination, and they lie one anterior to the other. The anterior of these probably corresponds with the dorsal tooth of the mandible of *Ancistrona gigas;* if so, it has changed its position so that its tip is as far forward as that of the posterior tooth, and these two have become fused into a single process. The anterior tooth, however, does not reach quite as far inwardly as the posterior one, and is also a little dorsal to it. Both of these positions correspond with those of the dorsal tooth of *Ancistrona gigas* and *Læmobothrium.* A large thick process projects inwardly from the inner dorsal angle. This very evidently corresponds with the extremely similar process from the posterior inner angle of the right mandible of *Ancistrona*, and with the less similar but certainly homologous process of *Læmobothrium.* This projection is the inner end of a posterior thickening of the mandible which bears near the outer angle of the base, on the posterior aspect, the articulating condyle. This projects dorsally, and fits into a socket on the ventral side of the head. On the anterior side of the mandible, somewhat more ventral than the condyle, is the articulating facet into which fits a condyle from the ventral surface of the head. The facet presents the peculiarity of having no inner wall, and is separated only by a constriction from a large cavity in the anterior thickened part of the mandible. This cavity is elongated in a line extending from the facet to the two teeth of the mandible. The posterior wall of the cavity is very thin.

Attached to the dorsal border of the inner angle of the mandible is a large thin chitinous plate (plate lxi, fig. 9, *ch. pls.*). This plate is thickened proximally and appears here darker than the rest. This part is also narrow, but distally the plate expands and becomes very thin and transparent. The distal border is not definite, being very thin and generally irregularly broken away. Attached to this plate are the retractor muscles of the mandible. The plate and muscles extend dorsally and very slightly backward from the mandible, since they lie in the same plane as the latter. From the outer posterior angle of the mandible there extends dorsally and outward a slender, very thin, chitinous structure, which bears the extensor muscles of the mandible. These two sets of muscles are attached to the dorsal wall of the head. The left mandible is very similar to the right. The two teeth are more of *Eurymetopus taurus.* Besides these, however, there are two forked rods projecting into the mouth cavity, as in the case of *Ancistrona gigas.* These rods are extremely slender and difficult to dissect, but they lie just dorsal to the labium, and pass forward beneath the œsophagus, and ventral to the glands connected with the pharyngeal sclerite. Only the bifid tips project into the mouth. Near the anterior end muscle fibres are inserted which pass forward and downward to their origin on the dorsal side of the labium. These evidently serve to draw the rods forward. Those of *Ancistrona gigas,* which is enormous amongst Mallophaga, are almost invisible to the naked eye, being weakly chitinized, and only .5 mm. long by .05 broad at the widest place. Only one specimen of the species of *Læmobothrium* described was had for dissection, and the rods may have been present but overlooked. Also it cannot be stated that they do not occur in *Eurymetopus taurus.* It is to be noticed that the genera *Ancistrona* and *Goniodes* belong to the two different subgroups of the Mallophaga.

## RESUMÉ.

From these detailed accounts of the mouth-parts of four genera of Mallophaga, equally divided between the two principal groups of the order, we may confidently make a summary statement of the condition of the mouth structures of the Mallophaga.

The mouth-parts are confined to the ventral aspect of the much flattened head, the frontal margin of the head being formed by the greatly developed clypeus. The labrum is the foremost of these ventrally located mouth structures, and is well developed, serving for prehension, and in some cases as a disk or platelike sucker for attachment. It appears as a simple flap lying in front of, and, when at rest, partly over the mandibles.

The *mandibles* are large and strong, usually roughly triangular in profile, with at least one projecting sharp-pointed tooth, and one or two blunter teeth. Each mandible presents a characteristic facet and a condyle which articulate with two strong chitinous rami attached one to the ventral wall of the head and one to the dorsal wall. One ramus articulates by a condyle with the facet of the mandible, and the other by a facet with the condyle of the mandible. The mandibular muscles are exceptionally large. In the two genera of the suborder Amblycera, the mandibles lie in a plane parallel to the horizontal plane of the head, while in the two genera of the suborder Ischnocera, the mandibles project in a plane nearly or quite at right angles with the horizontal plane of the head. This remarkable difference is probably characteristic of the two main groups of the order. The mandibles, though varying somewhat in shape in the two groups, are essentially similar in general character and in manner of articulation; the articulations in the Amblycera lie in a dorso-ventral line, while in the Ischnocera they lie in a cephalo-caudal line; if, however, the Amblycerous mandibles be tally, and bears few to many small teeth. Sometimes the distal part of the maxilla is two-parted and these two parts may represent the galea and lacinia of the typical maxilla of the orthopterous type. The maxillary palpi are completely lost, there being no indication of them on any of the maxillæ examined.

The *labium* (see, in addition to figures previously referred to, plate lxiii, figs. 1, 2, 3, 5, and 6) shows some considerable variation in the two suborders. In the Amblycera it is a larger and more complete structure than in the Ischnocera. A distinct submentum, mentum, and ligula are always present, the ligula consisting of the two terminal lobes, glossa, and paraglossa of each constituent half of the labium, united at their bases. With the Amblycera conspicuous 4-segmented palpi rising from a basal segment-like palpifer are always present; while with the Ischnocera palpi are wanting. The ventral or other surface of the labium is in some forms (see *Ancistrona gigas*) provided with strong backward-projecting, pointed, sometimes bipartite processes, as with *Ancistrona gigas*, *Menopon tridens*, *Menopon robustum*, and others. These processes must subserve some holding on or clasping function.

A hypopharynx of elaborate structure was observed in *Ancistrona gigas*, but not in the other species dissected. Grosse refers to a delicate membranous fold of the ventral wall of the mouth, which in some forms projects beyond the ligula as the hypopharynx.

The "forks" observed in *Ancistrona* and in *Goniodes*—genera representing both suborders of Mallophaga—because of their similarity to the familiar "forks" of the Psocidæ are of exceptional interest, and have not heretofore been referred to in the literature of the Mallophagous mouth-parts. Most plainly discernible in *Ancistrona*, they are very small, fine, chitinous rods lying inside of the mouth above the labium, whose posterior ends are attached to the ventral wall of the head by muscles and whose anterior ends are shortly forked or bifurcated, and project through the lining of the ventral wall of the mouth, thus lying free and uncovered in the mouth cavity. Although not observed in the other two genera of Mallophaga dissected, it is not at all certain that they are not present, their extreme minuteness and delicacy making their discovery a matter of difficulty.

The œsophageal sclerite and glands are also structures of extreme interest from their probable identity with similar structures in the Psocidæ. They do not appear to be present in all the Mallophagous genera; but I have observed them in a majority of the genera, viz., *Docophorus*, *Nirmus*, *Lipeurus*, *Eurymetopus*, *Goniodes*, *Goniocotes*, *Giebelia*, *Oncophorus*, *Trichodectes*, *Colpocephalum*, and *Menopon;* also in Piaget's figures of *Akidoproctus* the sclerite is indicated. I have found the sclerite and glands absent in *Ancistrona*, *Nitzschia*, *Trinoton*, *Læmobothrium*, and *Physostomum*. It will be noted that the sclerite and glands are present in all Ischnocera examined, and in two of the Amblycerous genera; while in a number of other Am-around it, and attach by their ends to the dorsal wall of the head. Opening into the median groove from its ventral side is a small duct, which, followed to its source, is seen to come from the union of a pair of ducts, each one of which comes from an oval gland lying ventral to the sclerite, and fitting into a concavity on the anterior end of a weakly chitinized, pedicle-like structure, which projects backward and is attached by a foot-shaped expansion to a large, strong muscle. This sclerite, which I call the "œsophageal sclerite," shows distinctly through the dorsal and ventral walls of the head, so that it is usually a conspicuous feature in the markings of the head, appearing as a V- or U-shaped mark with thickened sides (see this mark in the various figures illustrating the systematic part of this paper). It is this sclerite which has been called in the monographs of the European writers the labium, and in my "New Mallophaga, I," I have constantly referred to it by the same name. It is this sclerite, too, undoubtedly, which is the subject of Melnikoff's references, in his embryological memoir, to a sucking apparatus. Grosse refers to this sclerite as the Schlundskelett, and describes it, briefly, in *Tetraopthalmus chilensis (= Menopon titan)* and *Goniodes dissimilis*. He found also a chitin thickening of the dorsal wall of the pharynx, immediately above the ventral sclerite.

The mouth-parts of the Mallophaga are distinctly fitted for biting; there are no mouth structures which lend any probability to the old theory that the Mallophaga took food by sucking. The peculiar pharyngeal structures, while not yet understood in point of function, are not at all of a character to suggest anything like a sucking function. Grosse comes to no definite conclusion regarding the function of these œsophageal sclerites, but he says: "Ich schliesse aus seinem Bau, dass derselbe nicht zum Saugen, sondern zur Ergreifung und zur Führung der aufgenommenen Federtheilchen dient.'' All of my observation, as far as it goes, tends to substantiate the belief, based on the structure of the mouth-parts, that the Mallophaga take all their food by biting. I have seen them biting off and eating the bits of feathers, and the crop content, which shows plainly through the skin of many specimens, is always composed of tiny bits of feathers.

## Comparison with the Mouth-Parts of Allied Insects.

It should be of interest now to compare the mouth-parts of Mallophaga with the mouth-parts of those insects which have been placed in recent classifications nearest to the Mallophaga. Since the breaking down of Erichson's catch-all order, Pseudo-Neuroptera, the association of the Mallophaga, Termitidæ, Perlidæ, Embidæ, and Psocidæ, into the order Platyptera has been, until very recently, the usually accepted interpretation of the place of the Mallophaga among insects. The most recent classifications assign to the Perlids, Termites and Mallophaga ordinal rank. Undoubtedly the Mallophaga are to find their well developed, with distinct cardo, stipes, palpifer, 4-segmented palpus, and both terminal lobes, the lacinia sharply two-pointed, and the outer hoodlike galea fleshy; labium (plate lxiv, fig. 1) with elongate elliptical submentum, mentum, 3-segmented palpi, and ligula showing in each half both glossa and paraglossa. The Termite species whose mouth-parts I figure to illustrate the general character of the Termite mouth structures is *Termopsis angusticollis*, a large form common in California.

The Perlidæ, as the Termitidæ, present the generalized biting type. In the adult Perlids, to be sure, the mouth-parts seem to be hardly functional, being reduced to a semimembranous condition, with some correlated changes in form. In the nymphs, however, the usual Orthopterous form is shown. I have figured the mouth structures of a nymph of *Perla* (plate lxiv, figs. 3 and 4). The mandibles of the adult are very small and but slightly chitinized.

## THE MOUTH-PARTS OF THE PSOCIDÆ.

(Plate lxiv, figs. 5-11.)

The mouth-parts of the Psocidæ present a modified or specialized type of biting mouth-parts. They have been the subject of some study and some dispute, and perhaps are not yet fully understood. An especially confusing feature is the presence of the "forks," and characteristic and little understood organs are the paired "lingual glands" lying "within the tongue." The best paper on the Psocid mouth-parts is one by Edward Burgess,* in which special attention is given the forks and the lingual glands.

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*Burgess, Edward. The Anatomy of the Head, and the Structure of the Maxillæ in the Psocidæ. Proc. Bost. Soc. Nat. Hist., 1878, vol. xix, p. 291, pl. viii.

In the two subfamilies of the Psocidæ, the winged Psocinæ and the degraded, wingless Atropinæ, the attitude of the head varies from a hanging or vertical position in the Psocinæ to the nearly horizontal position of *Atropos*. With the change from vertical to horizontal position there goes a marked flattening of the head, so that the head of *Atropos* (plate lxiv, figs. 5 and 7) in its horizontally projected attitude, its flattened condition, and the limiting of the mouth-parts to the ventral aspect of the head, shows both in its relation to the body of the insect and in its own shape and condition, a great similarity to the horizontal, flattened head of the Mallophaga. The clypeus of *Atropos* is large, projecting far forward, and, as in the Mallophaga, forms the frontal margin of the head, the labrum lying on the ventral aspect of the head (plate lxiv, fig. 5). All the mouth-parts lie on the ventral aspect of the head (plate lxiv, fig. 5) The mandibles (plate lxiv, figs. 5, 6, and 8) are strong, toothed, and present distinct protruding condyles wholly similar in position and general character to those of the Mallophaga (see plates lx–lxiii). The maxillæ (plate lxiv, fig. 5) I do not understand, but there are no conspicuous terminal free lobes; there is a large basal part, and artic-

Burgess has studied the mouth-parts of *Psocus* in detail, and for the sake of his accounts of the forks, and of the œsophageal sclerite and lingual glands, those structures so characteristic of the Psocidæ, and probably—certainly, in the case of œsophageal sclerite and lingual glands—quite as characteristic of the Mallophaga, I quote from his paper referred to, as follows:—

"The maxilla in *Psocus* is hinged to the head by a small obscure piece which is immovably soldered to a larger joint. The first piece represents, probably, the cardo of a typical maxilla (plate lxiv, fig. 10, *c)* and the second the stipes *(p)*. The stipes bears outwardly the 4-jointed maxillary palpus, while inwardly is hinged a thick, fleshy lobe, broad at the base, but soon contracting and curving inward. The tip is flat and has a broad, oval outline on the inside, and is strengthened by several imbedded chitinous rods and other pieces. This lobe, by its position and shape, is doubtless homologous with the ordinary outer maxillary lobe, or galea, of the other Orthoptera. Behind the lobe, that is between it and the tongue, lies the 'horny process' of Westwood's description, or 'fork,' as I shall call it. This is a slender, more or less curved chitinous rod with a forked bifid tip, and two or three times as long as the outer lobe (plate lxiv, figs. 9 and 10, *f)*. The distal portion of the fork, about one-third or less of its length, projects through the lining membrane of the mouth. At this point the fork is stoutest, and from it, it tapers to either end, the outer portion being stouter than the inner. The membrane where it is united with the fork is delicate and elastic, thus permitting the fork to be projected forward or drawn back at will. Within the head the fork is held in position by muscles inserted on its base, which unite it with the lobe and stipes of the maxilla, and by a ligament which runs backward to the top of the head. Of these muscles one is inserted on the base of the lobe; two others are inserted apparently within the stipes; by their contraction the fork is thrown forward out of the mouth, or moved about. The backward-running cord, which is double, is apparently neither muscular nor the tendon of a muscle, but simply an elastic ligament to draw the fork back, and probably the membrane pierced by the fork aids in the same movement. The fork is still further held in place by the flexor muscles of the stipes and lobe which pass behind it and serve to bind it down against the lobe.

"In the maxilla we have recognized cardo, stipes, and outer lobe, and one naturally asks if the fork is the homologue of the inner lobe of the typical maxilla, or an independent organ. At present I must incline to the latter view, although some may regard the absence of anything else to represent the inner lobe as sufficient evidence of their homology. But there is no articulation of any kind between the fork and the outer lobe, and the peculiarity of the muscular connections seem rather to favor the idea that the fork may represent an independent organ.

"The maxillæ and mandibles occupy the lower half of the large oral cavity which opens above into a thick-walled presently to be described. Just below this bone there is a double elevated ridge covered with short hairs (plate lxiv, fig. 11).

"The lower lip (plate lxiv, fig. 10) is composed of an oblong mentum *(m)* bearing a larger labium *(lb)* narrowed at the base, then expanding so as to have a bisinuate, almost S-shaped lateral outline; the lower edge bears two short, broad lobes, and two stumpy, one-jointed * palpi *(l.p.)*. The labium in profile (plate lxiv, fig. 9) is very thick, and the lower edge is divided into two narrow laminæ, while still a third lamina, well separated from the first two, forms the tongue (plate lxiv, fig. 9, *t*). Within the tongue lie a pair of peculiar organs which may be called the lingual glands (plate lxiv, figs. 9 and 10, *l.g.*); these can be seen through the semitransparent mentum and labium, as in plate lxiv, fig. 10, offering an irregular, obovate outline. A short duct from the lower end of each gland leads into a common duct *(l.d.)* which opens in the œsophageal bone as already described.

"The ducts curve over the lower end of the glands and run up their posterior surface, to which they are soldered nearly to the top. The line of the ducts, together with the lateral outlines, give the glands a three-cornered shape, somewhat like that of a butternut. A little triangular cap fits on the summit of each gland, and on it is inserted a suspensory muscle, the upper end of which is attached to the cranium (plate lxiv, figs. 9 and 10, *g.m.*). The specimens at my command have not been fresh enough to study the histology of these organs, but they seem to be composed of an outer sack, with a thin tough wall which

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"* With Westwood I regard these pieces as true palpi, and not as a second pair of labial lobes."

is light yellow and has a slightly roughened or granular surface. The interior is filled with cells, and perhaps may be glandular. The excretory ducts are thick-walled and strengthened by circular threads, as is often the case with the salivary ducts of *insects."

Scudder in his note "on the structure of the head of *Atropos*," in "Psyche," 1877, vol. ii, p. 49, gives a different account of the fork, saying that "instead of forming a single, simple, rodlike process, this inner lobe [=fork] is three or four times as long as has been presumed, and is two-jointed, the apical point lying, when the organ is at rest, beside the basal joint, which is attached to the maxilla at the extreme base of the latter; the basal joint is directed backward and lies almost directly beneath the basal portion of the apical joint." Mr. Scudder believes that the fork is without any doubt homologous with the customary inner lobe, or lacinia of the maxilla. As will be noted in the foregoing quotation from Burgess, this author believes Scudder's account of the fork as a two-segmented organ to be erroneous, and he inclines to the belief that the fork is an independent organ, and not a part of the maxilla.

type of mouth-parts, and offer besides this no special resemblances to the Mallophagous condition. There is no indication in the mouth-parts of the Termitidæ, wingless and specialized though the Termites are, of modifications in the direction of the Mallophagous mouth-parts. In fact, considering the food habits of the Termites and the specialization (by degradation) of their bodies, the mouth-parts show a surprising faithfulness to the simple usual Orthopterous type.

It is in the comparison of the Mallophagous mouth-parts with those of the Psocidæ that such interesting resemblances and parallel or homologous structures appear as to give basis for a belief in the near relationship of the two groups.

The comparison of the mouth-parts of the Mallophaga and the Psocidæ is not made here for the first time. In 1887 Dr. A. S. Packard read a paper before the American Philosophical Society entitled: "On the Systematic Position of the Mallophaga," in which he makes such a comparison. Dr. Packard based his paper on the studies of Melnikow and Grosse on the Mallophaga, and of Burgess on the Psocidæ, and on his (Packard's) own studies. In this paper attention is called to the general similarities shown in the two groups in the position of the mouth structures, due to the great development of the clypeus, in the shape of the mandibles, in the reduction of the maxillæ, etc.

In the light, however, of the preceding detailed accounts of the mouth-parts of *Ancistrona*, *Læmobothrium*, *Eurymetopus* and *Goniodes* (Mallophaga), with their detailed descriptions of the œsophageal sclerites and glands, and the "forks" of *Ancistrona* and *Goniodes*, the comparison of the Mallophagous and Psocid mouth structures may profitably be carried farther than has yet been done.

The flattening of the head, with the great development of the clypeus, and the restriction of the mouth-parts to the ventral aspect of the head, so characteristic of the Mallophaga, is quite as characteristic of *Atropos*, the wingless, degraded Psocid. Among the winged Psocidæ the head hangs vertically, and although there is a similar great development of clypeus, there is less flattening of the head and less general resemblance. The peculiar condition of the labrum in the Mallophaga, lying as it does on the ventral aspect of the produced clypeus, finds an identical repetition in *Atropos;* a point which Packard seems to have overlooked when he says that the Mallophaga differ from the Psocids in having the labrum covered by the clypeus. In the winged Psocidæ the head is not horizontal as with the Mallophaga and *Atropos*, and the labrum is attached to the ventral margin of the clypeus.

The mandibles of *Atropos* present a really striking similarity with those of the Amblycerous Mallophaga. The details of teeth, condyles, facets, and musculation are extraordinarily alike.

The maxillæ of the Psocidæ are greatly reduced, retaining, however, a well developed palpus. In the Mal-glands of the Mallophaga, with the characteristic "œsophageal bone" and glands of the Psocidæ. The comparison of these structures in the two groups reveals an agreement in position and character so nearly identical as to preclude any supposition of independent origin. Also, there is to be noted the presence, in certain genera of the Mallophaga, of a pair of "forks," very much reduced in size, and not yet well understood. These forks seem very like the familiar and characteristic Psocid forks, so far apparently found among no other insects.

It is not intended to discuss here, at all, the probable relationship of the Psocidæ and Mallophaga, simply to point out the peculiar and interesting similarity of mouth structures, as so far brought out in the study of the groups. It is of interest to note in this connection the rather similar food habits of the two groups, the Psocidæ feeding on dry, dead organic matter, such as wood and paper, dried insects, and dried bird and mammal skins; and the Mallophaga feeding on the dry, dead dermal scales, hairs, and feathers of mammals and birds. I have found *Atropos* not infrequently in the nests of birds.

## DESCRIPTIONS OF NEW SPECIES.

### Docophorus.

**Docophorus taurocephalus** n. sp. (Plate lxv, fig. 1.)

Two males and a female from an American Rough-legged Hawk, *Archibuteo lagopus sancti-johannis* (Lawrence, Kansas). A member of the group dilatatoclypeati, found on eagles and hawks and characterized by the more or less prominent, uncolored frontal expansion of the clypeus. The new form resembles Nitzsch's *gonorhynchus* (Giebel, Insecta Epizoa, p. 70), from *Astur* *nisus*, in the emargination of the clypeus, and it shows, also, what Piaget affirms to be merely an individual character, the effacement of a distinctly limited signature, as spoken of by Nitsch. The new form is markedly larger than *gonorhynchus*, and the male has no transverse linear blotch on the last segment.

Description of male. Body, length 2.06 mm., width 1 mm.; strongly colored.

Head, length .78 mm., width .78 mm.; thus being very large in proportion to the size of the body; front with shallow emargination, the projecting lateral parts angulated; clypeus expanded laterally behind these frontal angles, and the uncolored expanded portion bearing two conspicuous, longish hairs; a short marginal hair just in front of the suture, and two longish hairs rising on dorsal surface and projecting beyond margin between suture and trabeculæ; trabeculæ broad, not reaching beyond end of segment 1 of antenna; eye projecting, pendulous, with angulated cornea, and bearing a hair; temporal margins flatly rounded and bearing four long hairs, and on occipital side of posterior angle a short hair; occipital margin nearly straight, bare; general color of head light translucent brown; signature indistinctly limited, its obtusely angled posterior margin, bearing on the mesal third eight weak, non-pustulated hairs, and in the lateral angles two longer and stronger hairs; large, transverse, lateral blotches separated by a narrow, uncolored, mesal, linear space widening anteriorly; legs pale brown, with dark brown markings on dorsal margins of femora and tibiæ.

Abdomen broadly elliptical, short, segments projecting little or not at all at sides, and with two to three long hairs in posterior angles; a single transverse series of hairs on dorsal surface of each segment; lateral transverse blotches large, and with pointed inner ends; lateral bands darker, not distinctly limited; posterior margin of last segment flatly rounded, with numerous longish hairs which are confined to the lateral portions of the margin.

Female. Body, length 2.53 mm., width 1.04 mm.; head, length .87 mm., width .87 mm.; the lateral abdominal blotches much shorter, the hind body tapering posteriorly, and the ninth segment narrow, uncolored, tapering behind, and narrowly angularly emarginated so as to produce two short acute points.

**Docophorus alienus** n. sp. (Plate lxv, fig. 2.)

Found on a Yellow-shafted Flicker, *Colaptes auratus* (Lawrence, Kansas). This species does not resemble any of Nitzsch's or Piaget's *Docophori* taken from woodpeckers, but belongs to Piaget's group *latifrontes*, found on the cuckoos. The group is characterized, according to Piaget, by the width and emargination of the clypeus, and by the large size of the posterior legs. The clypeal characters are presented by this new form, but the posterior legs are not especially enlarged.

Description of the male. Body, length 1.62 mm., width 7 mm.; the only specimen is a recently moulted one, so that the chitinization is incomplete, and the color is nearly lacking. If it were not for the well marked clypeal characters, which indicate its affinities unmistakably, I should not describe the specimen.

Head, length 56 mm., width 53 mm.; front broad, angularly emarginated; two submarginal hairs between the suture and the anterior angles of the clypeus, of which the hinder is much the longer; a short hair at the suture, and three short ones in front of the trabeculæ; the trabeculæ very long, reaching to end of segment 2 of antennæ; eye prominent, with a hair and black fleck; four longish hairs on temporal margin; occipital and antennal bands pale, but evidently to be well chitinized; signature broad, emarginate on anterior margin.

Prothorax short, with rounding angles, and with single hair in posterior angles; indications of strong, even, lateral bands. Metathorax obtusely angled on abdomen, with a series of pustulated hairs along posterior margin; indications of large lateral blotches. Legs concolorous with body.

Abdomen broadly elliptical, with long hairs in posterior angles of segments, and one transverse row of hairs across temporal angles more convexly rounded; metathorax obtusely angled on abdomen, and with transverse blotch, with posterior margin not parallel with the posterior margin of the segment; thorax relatively broader than in *communis*. Measurements of male: Body, length 1.72 mm., width .75 mm.; head, length .59 mm., width .56 mm. Female: Body, length 2.12 mm., width .90 mm.; head, length .63 mm., width .63 mm.

**Docophorus domesticus** n. sp. (Plate lxv, fig. 4.)

Males, females, and young taken from the Purple Mar tin, *Progne subis* (Lawrence, Kansas). Most nearly like Nitzsch's *excisus* (Giebel, Insecta Epizoa, p. 88, pl. xi, figs. 1, 2, 3) found on *Hirundo urbica* and *Cypselus apus*, but markedly larger. Piaget calls *excisus* one of the smallest *Docophori* known, and gives the average length of the males as 1. to 1.1 mm., and of the females as 1.2. My specimens average in length, males, 1.47 mm., females, 2 mm.

Description of the male. Body, length 1.47 mm., width .59 mm.; thorax and head pale golden brown, with light brown markings; abdomen darker, with large dark brown lateral blotches.

Head, length .5 mm., width .48 mm.; front of clypeus emarginated rather squarely, the bounding mesal angles of the clypeus nearly rectangular; a longish prominent hair rising from the dorsal surface near the margin in each rounded latero-anterior angle of the clypeus, a short marginal hair behind it, another at the suture, two others close together and rising from the dorsal surface near the margin behind the suture, and a single short, marginal hair just in front of the trabeculæ; the trabeculæ large, acutely pointed, reaching middle of segment 2 of antennæ; antennæ, if projected backwards, reach the posterior margin of the head; eye prominent, with a longish hair; temporal margin with one hair behind, but close to the eye, and two other hairs and two prickles; occipital margin sinuous, bare; signature indistinct, with anterior margin emarginate; no distinct posterior point; occipital bands brown, forking: antennal bands pale smoky brown, interrupted.

Prothorax with rounding sides and angles, rather long, and with a single hair near each end of posterior margin; a broad, even, translucent, lateral band. Metathorax rather long, angulated on abdomen, with a series of pustulated hairs along posterior margin and a broad, lateral, brown band along the antero-lateral sides. Legs robust, pale brown, with dark brown marginal markings and few scattered hairs.

Abdomen broadly elliptical, segments projecting slightly laterally, with one to two or three long hairs in the posterior angles: dorsal surface with numerous weak hairs arranged in transverse lines, a single series on each segment; segments 1–7 with large, dark brown, transverse, lateral blotches, each blotch with an uncolored stigmatal spot, and a few demi-pustulations with hairs along the

**Docophorus distinctus** n. sp. (Plate lxv, fig. 5.)

Many specimens, males, females, and young, from the American Raven, *Corvus corax sinuatus* (Colorado). This form belongs to the *corvinicolæ* infesting the Corvini and is of the type *atropicti* characterized by the whitish ground color of the body, and sharp black markings. The new species differs from Nitzsch's *atratus* (Giebel, Insecta Epizoa, p. 81, pl. ix, fig. 10) from *Corvus frugilegus* by the long hairs of the clypeus; from Nizsch's *ocellatus* (Giebel, Insecta Epizoa, p. 81, pl. ix, figs. 7 and 8), from *C. cornix* and *C. corone*, by lacking the strongly marked bands on the temples, and by the short signatures; and differs from Piaget's *albidus* (Les Pediculines, p. 48, pl. iii, fig. 6) from *C. scapulatus* by the pustulated hairs of temples and metathorax.

Description of the male. Body, length 2 mm., width 1.06 mm.; ground color whitish with distinct, sharply defined, black markings.

Head, length .63 mm., width .72 mm.; very broad in front and truncate; five long marginal hairs on each side of forehead, one at base of antennæ, one in eye, one just behind the eye, and three on the temporal margins; occipital margin straight, bare; antennæ with segment 1 large and swollen, segment 2 slender and longest, segments 3–5 short, subequal and colored dark brown, segments 1–2 uncolored; signature very short, or at least with only a short, oblong, anterior part colored; antennal bands broad, irregular, interrupted at the suture, and with subparallel inner bands; occipital bands very distinct, diverging and meeting the expanded basal extremities of the antennal bands; ocular bands narrow, distinct, and extending around behind the eye; a shield-shaped occipital signature showing through.

Prothorax narrow, with strong, black, lateral borders, and a fainter narrow diagonal line running inward and backward from each side; the pericoxal and intercoxal lines of prosternum showing through; one hair in each posterior angle. Metathorax angulated on abdomen, with a series of pustulated hairs along posterior margin; antero-lateral sides with strong black border; postero-lateral sides with paler, brown, linear, tapering blotch. Legs concolorous with body, with black marginal and annular markings.

Abdomen very broadly elliptical, suborbicular; not turbinated; with long weak hairs in posterior angles; last segment flatly rounded behind; the transverse lateral blotches smoky brown, with darker lateral borders, large uncolored stigmatal spots, and about six demi-pulstulations along the posterior margin of each blotch; some of the outermost of these pustulations are complete; many weak hairs on dorsal surface; genitalia showing distinctly in segments 6–9, broad and shortly three-pronged posteriorly; segment 8 with transverse blotch entirely across segment; segment 9 uncolored.

Female. Body, length 2.5 mm., width 1.34 mm.; head, length .72 mm., width .81.; abdomen more elongate, This forcipated clypeus is found also in *D. pertusus* N. (on *Fulica*) of the group *emarginati*.

Description of female. Body, length 2 mm., width .9 mm.; forehead light golden brown, hindhead dark brown, thorax and abdomen strongly blotched with dark brown, abdomen with interrupted narrow, black, lateral bands.

Head, length .56 mm., width .59 mm.; front with a subcircular emargination enclosed in front by mesad-projecting, acute, forceps-like points; no marginal hairs on forehead excepting three or four short ones just in front of trabeculæ; the trabeculæ are rather long, reaching beyond end of segment 1 of antenna; eye with a hair; temporal margins with two longish hairs and a short one between them; occipital margin sinuous, bare; signature broad and very pale, and indistinct anteriorly, with a short, obtuse, posterior point which is darker colored; antennal bands broad, short, paling into general color of forehead; ocular bands fairly distinct, as also the occipital bands; temporal regions dark brown with narrow blackish border outwardly; a narrow black occipital border.

Prothorax with rounding sides and angles, with a single weak hair in each posterior angle; broad, dark brown lateral borders paling outwardly and darkest in posterior angles; two indistinct narrow dark lines running diagonally inward from each lateral border. Metathorax with rounding lateral angles, obtusely angled on abdomen and with a series of pustulated hairs along posterior margin; two linear transversal blackish blotches projecting inward from each side, the anterior blotch much the larger and more distinct. Legs dark brown with blackish marginal markings and semiannulations at extremities of femora.

Abdomen obovate, sides somewhat turbinate but with the projecting angles rounded; segments 3–6 with two or three short hairs in posterior angles, segment 7 with one hair in angle; segment 8 much narrower than segment 7 and somewhat retracted into it; segment 9 hardly visible, being almost wholly concealed within segment 8; segment 1 with complete transverse blotch deeply medianly emarginated on its anterior margin; segments 2–7 with lateral, dark brown, transverse blotches separated by the paler median third of the body surface and blunt within; each blotch with a distinct uncolored stigmatal spot, but without pustulated hairs; blotch of segment 8 extending entirely across segment; four longitudinal rows of weak nonpustulated hairs, two rows in median paler space, and one row in each lateral series of transverse blotches; distinct, black, lateral bands widening posteriorly and segmentally interrupted.

**Docophorus evagans** n. sp. (Plate lxvi, fig. 2.)

Taken from the Downy Woodpecker, *Dryobates pubescens* (Lawrence, Kansas). This *Docophorus* is a member of Piaget's woodpecker infesting group *angustifrontes*, characterized by the anterior narrowing of the head with small trabeculæ, and the elongate Nirmoid form of the body. It departs from the more typical forms of the margins with two longish hairs; occipital margin weakly concave, almost straight and bare; narrow antennal bands, and temporal borders shining dark brown.

Prothorax short, with narrow marginal band and no hairs. Metathorax acutely angled on abdomen, the angle produced; beginning in lateral angle five long hairs along each latero-posterior margin, the mesal third of the posterior margin being free from hairs; a narrow, indistinct, lateral border. Legs concolorous with body, with narrow, dark brown, marginal markings. Sternum with narrow distinct intercoxal lines.

Abdomen elongate, subparallel-sided; a single longish hair in posterior angles of segments 3–4, and two hairs in angles of segments 5–8; two hairs also in middle of lateral margin of segment 8; segment 9 uncolored, narrowed and slightly emarginated behind; narrow, translucent, brown lateral bands, and faint indications of median transversal blotches which are probably the light brown transversal blotches of the under side showing through.

**Docophorus jungens** n. sp. (Plate lxvi, fig. 4.)

Found on two specimens of the Flicker, *Colaptes auratus* (Lawrence, Kansas). The new form belongs to Piaget's group *angustifrontes*, found on the woodpeckers, and presents the characteristic narrow clypeal front, the small trabeculæ, and elongate Nirmoid body. The members of the group undoubtedly stand in the position of gradatory forms between *Docophorus* and *Nirmus*.

Description of the male. Body, length 1.75 mm., width .65 mm.; very pale brownish, with darker marginal markings.

Head, length .56 mm., width .50 mm.; triangular, with narrow, anteriorly tapering clypeus which is concave in front; two short hairs just beyond the anterior angles, one short hair at the suture, and two slightly longer ones in front of the rather small trabeculæ; eye distinct, with a long hair; temporal margins flatly convex, with two long hairs; occipital margin weakly concave and sinuous, bare; ground color of head pale yellowish brown with narrow dark brown antennal bands, pale colored signature and narrow brown temporal margins fading out posteriorly; œsophageal sclerite showing through, and occipital bands indicated, especially at their posterior ends.

Prothorax small, with slightly rounded rectangular posterior angles and straight posterior margin, with one hair in posterior angles; pale lateral borders which bend inward at posterior angles. Metathorax short, broad, angulated on abdomen, with indistinct lateral blotch and six hairs along each latero-posterior margin arranged in two groups of three each. Legs concolorous with the pale body, with darker marginal blotches on femora and tibiæ.

Abdomen narrow, with few longish hairs in posterior angles of segments and a transverse series of a few longish hairs across each segment interrupted in the middle; lateral bands translucent pale brown, the segmental portions passing the sutures and projecting somewhat inward; indications of median transverse bands; last segment conspicuous, projecting, flatly rounded behind, and with a few longish hairs; genitalia showing through body wall.

Female. Body, length 1.93 mm., width .68 mm.; head, length .56 mm., width .58 mm.; abdomen more elongate and subparallel-sided; eighth segment with transverse blotch entirely across segment; ninth segment slightly angularly emarginate behind.

**Docophorus californiensis** n. sp. (Plate lxvi, fig. 6.)

Numerous specimens, male, female, and young from several specimens of the California Woodpecker, *Melanerpes formicivorous bairdi* (Palo Alto, California). Another member of the *angustifrontes*, of same size and outline as the last, but with strong and characteristic markings. It is very like *D. superciliosus* N. (Giebel, Insecta Epizoa, p. 94, pl. x, fig. 3), the type of the group taken by Nitzsch, Denny, and Piaget from *Picus major* and *P. viridis*. It appears to differ from *superciliosus* in the possession of hairs in the posterior angles of the prothorax, in the absence of numerous hairs on dorsal surface of abdomen, and in the sharper and more pronounced markings.

Description of the male. Body, length 1.75 mm., width .62 mm.; pale smoky brown, with dark brown to black bands and blotches.

Head, length .53 mm., width .47 mm.; triangular, forehead tapering, and clypeal front narrow and slightly concave, with two hairs in the anterior angles, one shorter one between angle and suture, a longer one just in front of suture, and two rather long ones in front of trabeculæ; eye prominent, with long hair; trabeculæ acute, reaching slightly beyond end of segment 1 of antennæ; temporal margins with two long hairs and a prickle; occipital margin sinuous, bare; clypeus paler than rest of forehead and hind head; signature pale but distinct; suture distinct; antennal bands, ocular blotch, and anterior temporal border blackish brown; temporal regions and rest of head, excepting clypeus and that part of hind head between the occipital bands, dark brown; œsophageal sclerite distinct.

Prothorax short, projecting considerably beneath head; posterior angles rectangular, with one hair; posterior margin evenly flatly convex; lateral border curving inwards along posterior margin blackish brown. Metathorax short; lateral angles obtusely rounding; posterior margin with obtuse produced angle and four or five hairs on each side; uneven lateral border and transverse blotch not contiguous to posterior margin, dark brown. Sternal markings consisting of intercoxal lines. Legs concolorous with pale smoky brown of body, with black marginal markings.

Abdomen elongate, about one-third wider than head, with few long hairs in very slightly projecting posterior angles of segments; a few hairs arranged in five uneven, longitudinal rows on dorsal surface; broad, pronounced, blackish, lateral bands, with distinct uncolored stigmatal spots and broad transverse blotches extending from band to band on segments 1–8; the blotches on segments 1–2 deeply emarginated medially on anterior margin, and the blotch on segment 7 faint in median part; segment 9 projecting, rounding, with several long hairs on posterior margin and a median blotch; genitalia showing in segments 7–9.

Female. Body, length 1.9 mm., width .72 mm.; head, length .6 mm., width .53 mm.; last segment of abdomen mens from *Strix otus* and *Strix brachyotus*. Denny collected the species from *Otus (Strix) vulgaris* and *Otus (Strix) brachyotus*, and Piaget from *Strix brachyotus* and from *Falco tinnunculus*. Picaglia (Pediculini dell' istituto anatomo-zoologico d. r. Univ. di Modena, Atti d. Soc. d. Nat. di Modena, 1885, ser. iii, vol. iv, p. 13) records *Bubo maximus*, *Otus vulgaris*, *O. brachyotus*, and *Tinnunculus alaudarius* as hosts of *cursor*. There is some discrepancy between Giebel's and Piaget's description of the species, especially touching the lateral emargination of the forehead, a character which, according to Piaget, is noticeable, and which indicates the affinities of *cursor* and the hawk-infesting *Docophori*. My specimens vary noticeably from the descriptions of the Old World forms, especially in the distinctly pendulous eye and the character of the genital blotches. They are also larger than the European specimens. Probably they should be given a varietal name. The species may be recognized by comparison with the figure. In the male the lateral abdominal blotches cover much more of the abdominal surface of course, and the specimens are smaller. My specimens measure—Male: Body, length 1.9 mm., width .75 mm.; head, length .62 mm., width .62 mm. Female: Body, length 2.22 mm., width .9 mm.; head, length .66 mm., width .66 mm.

**Docophorus ceblebrachys** Nitzsch (Plate lxvi, fig. 3).

Zeitschr. f. ges. Naturwiss. (ed. Giebel), 1861, vol. xvii, p. 528.

*Docophorus ceblebrachys* N., Denny, Monograph. Anoplur. Brit., 1842, p. 92, pl. i, fig. 3; Giebel, Insecta Epizoa, 1874, p. 77, pl. xi, fig. 15; Piaget, Les Pediculines, 1880, p. 29, pl. i, fig. 8.

Numerous specimens from two Snowy Owls, *Nyctea nyctea* (Lawrence, Kansas). Taken by Nitzsch, Denny and Piaget on individuals of the same bird species. A distinctly marked and isolated form peculiar, probably, to the Snowy Owl. It can be readily recognized by the broad short head, with short broadly truncate forehead, and correspondingly short and broad signature. The genital blotches of the ventral surface of the abdomen of both male and female are also characteristic. There is considerable difference in size of the male and female. The male which I figure measures: Body, length 1.78 mm., width .75 mm.; head, length .53 mm., width .6 mm. Female: Body, length 2.31 mm., width 1.03 mm.: head, length .62 mm., width .75 mm.

**Docophorus rostratus** Nitzsch. (Plate lxvi, fig. 5).

Zeitschr. f. ges. Naturwiss. (ed. Giebel), 1861, vol. xvii, p. 529.

*Docophorus rostratus* N., Giebel, Zeitschr. f. ges. Naturwiss, 1861, vol. xviii, p. 296; Burmeister, Handb. d. Ent., 1835, vol. ii, p. 427; Denny, Monograph. Anoplur. Brit., 1842, p. 87, pl. ii, fig. 4; Giebel, Insecta Epizoa, 1874, p. 76, pl. x, fig. 4; Piaget, Les Pediculines, p. 27, pl. i, fig. 7.

Two specimens of this unmistakable *Docophorus*, taken by Nitzsch, Denny and Piaget from *Strix flammea*, the European Barn Owl; taken by me from the American Barn Owl, *Strix pratincola* (Soquel, California). The American Barn Owl has always, until recently, been held to be simply a variety (*Strix f. pratincola*) of the Eu-

Universita di Modena, Atti della Societa dei Naturalisti di Modena, Serie 3, vol. iv, 1895.

> "Sinonimia—De-Geer. Mem. Ins. vol. vii, tv. 4, f. 9. 1776 (*Ricinus emberizæ*)—Schrank. Beit. zur Naturg. p. 117, tv. 5, f. 8. 1776 (*Pediculus curvirostræ*)—l. c. p. 117, f. 6 (*P. Pyrrulæ*)—l. c. p. 118, f. 7 (*P. Chloridis*)—l. c. p. 116, f. 9 (*P. citrinellæ*)—l. c. p. 115, f. 10 (*P. Rubeculæ*)—Linneo. Syst. Nat. Ed. xiii, v. ii, p. 2922. 1789 (*P. curvirostræ, Pyrrullæ, Chloridis, Citrinellæ, Rubeculæ*)—Panzer. Fau. Ins. Germ. p. 51, f. 27. 1793 (*P. Curvirostræ*)—Geoffroy. Hist. abr. Ins. v. 11, p. 599. 1800 (*Pediculus Emberizæ*)—Latreille. Hist. Gen. v. viii, p. 111. 1804 (*Ricinus Emberizæ*)—Fabricus. Sys. Ant. p. 349. 1805 (*P. Emberizæ*)—Olfers. De Veg. et. Anim. Corp. Anim. Rep. 1815 (*Nirmus globifer*)—Nitzsch. Germ. Mag. v. iii, p. 290. 1818—Burmeister. Hand. Ent. v. ii, p. 425. 1835—l. c. (*fusicollis*)—Denny. Anop. p. 70, tv. 5, f. 10. 1842—l. c. p. 82, tv. 1, f. 8 (*pallescens*)—l. c. p. 98, tv. 1, f. 8 (*fuscicollis*)—l. c. p. 104, tv. 5, f. 12 (*Passerinus*)—l. c. p. 106, tv. 3, f. 1 (*Merulæ*)—l. c. p. 107, tv. 3, f. 3 (*Modularis*)—l. c. p. 108, tv. 2, f. 2 (*Rubeculæ*)—Walckenær. Hist. Nat. Ins. Apt. v. iii, p. 332. 1844 (*Philopterus*)—l. c. p. 336 (*Philopterus pallescens*)—l. c. (*Philopterus fuscicollis*)—l. c. p. 340 (*Philopterus passerinus, merulæ, modularis, rubeculæ*)—Giebel. Zeits. f. ges. Nat. Bd. xvii, p. 298-303. 1861—l. c. (*fuscicollis*) p. 298—l. c. Bd. xviii, p. 298-303. 1861—l. c. p. 298. 1861 (*fuscicollis*)—Giglioli, Jour. of Micros. N. 10, tv. B, f. 9. 1864 (*Mandarinus*)—Giebel. Zeits. f. ges. Nat. Bd. xxvii, p. 116. 1866 (*ornatus*)—l. c. Bd. xxvii, p. 358. 1866—l. c. p. 359 (*fuscicollis*)—l. c. p. 359 (*ornatus*)—Epiz. p. 85, tv. xi, f. 13. 1884—l. c. p. 86, tv. 11, f. 10, tv. 20, f. 4 (*fuscicollis*)—l. c. p. 89 (*ornatus*)—l. c. p. 120 (*Rubeculæ, Modularis, Merulæ*)—l. c. p. 119 (*turdi*)—l. c. p. 91 (*lineatus*)—Piaget. Ped. p. 54, tv. 4, f. 2, 3, 4, 5, 7 (sp. et var.)."

The specific name *communis* given by Nitzsch to a *Docophorus* species or group of closely allied species found commonly on passerine birds, has been retained by Giebel and Piaget as the best, or, at least, most convenient expression of the condition exhibited by the *Docophori* of the type figured by Nitzsch from specimens from *Fringilla linaria*, and by Piaget from specimens from *Motacilla alba* and others. Specimens of this type are the most commonly met with *Docophorus* on passerine birds, and have been recorded from many species. Picaglia (l. c., p. 16) lists 43 species of European Passeres from which *communis* has been collected. But the variations exhibited by the specimens from the various bird species are many and sometimes striking. Giebel refers to variations exhibited by specimens from certain birds as being sufficient to warrant the founding of new species, but he merely refers to the general character of the variation shown by specimens from *Turdus pilaris*, *Parus major*, *Fringilla chloris*, and *Motacilla alba*. He lists 29 passerine birds representing 15 genera on which *communis* had been found at time of his writing. Piaget holds to the single species *communis*, referring to the variations apparent in any series of specimens, and describes and gives varietal names to 11 varieties. He selects the form found on *Motacilla alba* as typical of the species (believing it to be the same as found by Nitzsh on *Fringilla linaria*) and lists nearly 20 passerine bird species on which he has found *communis* and its varieties.

I have collected specimens of this *communis* species or group of species from the following American passerine birds: the Horned Lark, *Otocoris alpestris;* Red-winged Blackbird, *Agelaius phœniceus;* Western Meadowlark, *Sturnella magna neglecta;* Lapland Longspur, *Calcarius lapponicus;* Slate-colored Junco, *Junco hyemalis;* Cardinal Grosbeak, *Cardinalis cardinalis;* Bohemian Waxwing, *Ampelis garrulus;* White-rumped Shrike, *Lanius ludovicianus excubitorides;* Brown Thrasher, *Harporhynchus rufous;* and the Robin, *Merula migratoria*—all from Lawrence, Kansas; and also from Bullock's Oriole, *Icterus bullocki;* the California Purple Finch, *Carpodacus purpureus californicus;* the House Finch, *Carpodacus mexicanus frontalis;* the Pine Siskin, *Spinus pinus;* the Arkansas Goldfinch, *Spinus psaltria;* and the Sandwich Sparrow, *Amodramus sandwichensis*, from Palo Alto, California.

Variations among the specimens are apparent, but until I can examine a much larger series no attempt can be made to tabulate these variations. The species may be recognized by comparison with the figure in plate lxvi. This specimen, a female, was taken from a White-rumped Shrike, *Lanius ludovicianus excubitorides* (Lawrence, Kansas), and measures: Body, length 2. mm.; width .87 mm.; head, length 6 mm.; width .6 mm.

### **Docophorus excisus** Nitzsch.

Germar's Mag. f. Ent., 1818, vol. iii, p. 291.

*Pediculus hirundinis* Linnæus, Fau. Suec., 1746, p. 1963; Schrank, Fauna Boica, 1781; Fabricius, Sp. Ins., 1783, vol. ii, p. 483; Linnæus, Syst. Nat., ed. 13, 1779, vol. i, p. 2921.

*Ricinus hirundinis* Latreille, Hist. Gen., 1804, vol. viii, p. 111.

*Philopterus excisus* Nitzsch, Germ. Mag. f. Ent., 1818, vol. iii, p. 291; Burmeister, Handb. d. Ent., 1835, vol. ii, p. 425; Walckenaer, Hist. Nat. Ins. Apt., 1844, vol. iii, p. 333.

*Docophorus excisus* Nitzsch, Giebel, Zeitschr. f. ges. Naturwiss., 1861, vol. xviii, p. 298, l. c. 1866, vol. xxviii, p. 359; Giebel, Insecta Epizoa, 1874, p. 88, pl. ix, figs. 1, 2, 3; Piaget, Les Pediculines, 1880, p. 64, pl. iv, fig. 6.

Specimens which may be referred to this long known parasite of the swallows taken from the Cliff Swallow, *Petrochelidon lunifrons*, and from the Tree Swallow, *Tachycineta bicolor* (Palo Alto, California, and Lawrence, Kansas). The American specimens are, however, markedly larger than the European ones and should be designated by a varietal name. Piaget's measurements are, for males, length 1 m., for females 1.1 mm.; the males among my specimens are about 1.3 mm. long and the females 1.5 mm. long. The species of this group (with square emargination of clypeal front) which I have described from the Purple Martin (see page 475, plate lxv, fig. 4) shows all of the general habitus of *excisus*, but is so conspicuously larger and presents such constant minor differences that I have made it the type of a new species. The figure of it, however, will serve very well as a means of recognizing the American variety of *excisus*.

Var. *major* Kellogg. Male. Body, length 1.3 mm., width .56 mm.; head, length .44 mm., width .40 mm. Female. Body, length 1.49 mm., width .62 mm.; head, length .45 mm., width .42 mm.; the pustulations in lateral abdominal blotches more complete and distinct than in the type form of the species. Males, females, and young found on the Cliff Swallow, *Petrochelidon luni frons*, and on the Tree Swallow, *Tachycineta bicolor* (Palo Alto, California, and Lawrence, Kansas).

### NIRMUS.

**Nirmus longus** n. sp. (Plate lxvii, fig. 1.)

Taken from the Tree Swallow, *Tachycineta bicolor* (Lawrence, Kansas), and from the Cliff Swallow, *Petrochelidon lunifrons* (Palo Alto, California). A member of the group *interruptofasciati* and allied to Nitzsch's *N. gracilis* (Insecta Epizoa, p. 143, pl. vi, figs. 11, 12), which is only half as large and has but four (Giebel) or

Head, length .37 mm., width .28 mm.; elongate-conical, with narrow truncate front; two very small marginal hairs near the front, and one slightly longer a little distance in front of the trabeculæ which are small but distinct; eye flat, with a prickle in its posterior margin; temporal margins flat with a long hair and a prickle; pale golden brown with dark brown narrow antennal bands and temporal borders; oral fossa elongate, expanded behind, nearly uncolored.

Prothorax short, small, oblong, with single short hair in posterior angle, and even lateral borders which bend inward along posterior margin. Metathorax trapezoidal, with lateral margins converging anteriorly; posterior margin straight or weakly convex on abdomen, more curved at each end which projects laterally beyond the abdomen; posterior margin with six longish but weak hairs on each lateral third; indistinct lateral borders with anterior ends more distinct and a diagonal line projecting inward and forward from the posterior angles. No pronounced sternal markings. Legs pale, concolorous with body, with narrow darker marginal markings.

Abdomen very long and apparently slender, although really one-third wider than head; abdominal segments very gradually growing wider until segment 6 is reached, segment 7 slightly narrower, segments 8–9 narrower, abruptly tapering; a single short hair in posterior angles of segments; dorsal surface naked; segments 1–7 with distinct chestnut brown lateral bands; segment 8 of general body color; segment 9 uncolored, emarginated behind, with rounded points.

Male. Two males, which with much hesitancy I assign to this species, taken from a Cliff Swallow, *Petrochelidon lunifrons* (Palo Alto, California), are much smaller than the females. This condition is similar to that presented by *gracilis*, the males of which are .7 mm. long, while the females are .95 mm. long. The arrangement and number of metathoracic hairs are the same as in the females, and the head characters agree. Measurements of the male: Body, length 1.47 mm., width .43 mm.; head, length .34 mm., width .31 mm.

**Nirmus simplex** n. sp. (Plate lxvii, fig. 2.)

Found on a Robin, *Merula migratoria* (Lawrence, Kansas). It belongs to Piaget's group *interruptofasciati*, with antennal bands interrupted, with temples tending to become angular, and with the body blotches indistinctly colored.

Description of female. Body, length 1.77 mm., width [illegible] mm.; very pale yellowish brown, with darker but inconspicuous markings.

Head, length .33 mm., width .30 mm.; bluntly triangular, the rather narrow clypeal front truncate or very weakly concave; a single short hair in anterior angles and two other shorter ones on lateral margins; trabeculæ small, acute; eye flat, with a prickle in posterior edge; temporal margins fairly convex, with a single long hair

Metathorax broad, short, obtusely angled on the abdomen, with a series of non-pustulated hairs along posterior margin; a lateral marginal blotch with a part extending inward. Legs concolorous with body, with only faintly indicated marginal markings.

Abdomen bluntly elliptical, one-fifth wider than the head; with one to two or three weak hairs in posterior angles of segments, and a single transverse series of short weak hairs along the posterior margin of each segment; translucent, smoky brown lateral bands, and pale brown, broad, transverse blotches entirely across all segments; distinct uncolored stigmatal spots; segment 9 uncolored, with two small pale brown lateral blotches, slightly emarginated behind, and with a few longish hairs.

**Nirmus eustigmus** n. sp. (Plate lxvii, fig. 3.)

A single female of this well marked form from an Anna's Hummingbird, *Trochilus anna* (Palo Alto, California). The species belong to Piaget's group *interruptofasciati*. It is a much broader and much more robust form than *N. vulgatus*, the *Nirmus* of this group common among passerine birds, and the lateral bands of the abdomen are broad and pronounced.

Description of the female. Body, length 1.84 mm., width .62 mm.; pale yellowish white, with narrow blackish brown head borders, and broad, blackish lateral abdominal bands; indications of pale brown abdominal blotches.

Head, length .42 mm., width .45 mm.; broadly triangular, narrowly truncate in front; a few short weak hairs along margins of forehead, the longest being a pair considerably in front of the trabeculæ; trabeculæ small and uncolored but distinct; antennæ short, segment 2 most colored, segment 3 next; eye with a prickle; temporal margins with a single long hair and some fine prickles; occipital margin straight, bare; antennal bands blackish brown, not quite meeting in front, leaving a small uncolored space on frontal margin, and bending angularly in at posterior ends; narrow blackish brown ocular and temporal margins, paling gradually inward from margin of head.

Prothorax short, rectangular, with a single hair in posterior angles; blackish brown lateral borders. Metathorax trapezoidal, posterior margin very flatly convex on abdomen, with an angular indication at middle; six pustulated hairs on each outer third of the posterior margin; broad, ill-defined lateral border, with transversal lateral blotch extending from each side. Legs pale, with blackish brown dorsal marginal markings. Sternum with intercoxal lines but no median blotches.

Abdomen, elliptical; broad for this group of *Nirmi*, with posterior angles of segments, uncolored, blunt, projecting slightly; two or three hairs in posterior angles and a series of four longish hairs on the posterior margin of each of segments 2-7; segment 1 without hairs and segment 8 with more than four hairs; whitish, with dis-

Description of male. Body, length 1.56 mm., width .52 mm.; whitish, with brown median blotches and black marginal bands.

Head, length .37 mm., width 37 mm.; truncate or very slightly convex in front, with two or three very short indistinct marginal hairs; trabeculæ small and weak, reaching half way to segment 1 of antennæ; eye indistinct, with a fine prickle; temporal margins with two prickles and a weak hair; occipital margin straight, bare; antennæ with segment 1 uncolored; other segments dark brown, with wide uncolored sutures; antennal bands narrow, black, angulated almost at right angles and with the black color interrupted just in front of the angulation; bases of antennal bands meeting the inner ends of distinct, narrow, ocular bands whose outer ends meet anterior ends of narrow black temporal borders, with inner margins slightly crenate; short black internal bands parallel with anterior marginal parts of antennal bands; a shield-shaped occipital signature and oblong blotches at its sides showing through from under side.

Prothorax with flatly rounded sides and rounded posterior angles, each angle bearing one small hair; anterior angles containing a large dark brown blotch, and intercoxal lines of sternum showing through as black diagonal lines in posterior angles. Metathorax with rounding margins, rounded on abdomen, with five weak hairs in each lateral fourth of the posterior margin; small black linear blotches in anterior angles, and large irregular black lateral blotches not contiguous to the lateral margins, the sternal markings showing through dark chestnut brown. Sternal markings consisting of intercoxal lines and a median blotch on metasternum. Legs, femora and tibiæ with dorsal marginal black markings and a blackish brown annulation near distal extremity; tarsi paler brown.

Abdomen elongate, subparallel-sided, with posterior angles of segments projecting slightly, pointing backward and each bearing two weak hairs; dorsal surface of segments naked; last segment projecting, parabolic behind, with two pairs of long weak hairs and one pair of shorter ones; lateral bands narrow, distinct, black, interrupted, the anterior end of each segmental portion projecting beyond the suture and slightly inward; large median chestnut brown blotches on segments 1–7, each of these blotches (except that on segment 1) nearly crossed by a transverse linear uncolored space; on segments 6–7 the uncolored space is divided into two portions; in addition there are on segments 3–7 a pair of transversal dark brown lines, one on each side of the median line and lying superposed on median blotch, but extending a little farther laterally than the lateral margin of the blotch; some of these markings are on the ventral surface, but show through distinctly; segment 8 has a median blotch and two lateral markings composed of a brown line defining an elongate curving triangle, uncolored within; segment 9 has a median blotch and from its posterior margin two anteriorly projecting lines; distinct, slender, *hyemalis*, and the Robin, *Merula migratoria*, from Lawrence, Kansas.

It is allied to Nitzsch's *densilimbus (Fringilla carduelis)* (Giebel, Insecta Epizoa, p. 138), Piaget's *deficiens* (Les Pediculines, Supplement, p. 23, pl. iii, fig. 3) from *Cyanapolius cooki*, and other similar forms.

Description of female. Body, length 1.62 mm., width .41 mm.; pale, with distinct narrow blackish brown lateral bands and marginal head markings, and pale chestnut median abdominal blotches.

Head, length .37 mm., width .29 mm.; conical, with narrow parabolic front, without hairs; trabeculæ very small and uncolored but distinct; eye flat, with a fine prickle, and another just at its posterior margin; temporal margins with one longish hair and two prickles; occipital margin straight, bare; no signature; a longitudinal oral fossa expanded laterally behind; whole head narrowly bordered along lateral margins with blackish brown, the border turning angularly inward at antennal fossæ; a pale shield-shaped occipital signature showing through from below.

Prothorax narrow, quadrangular, with a single hair in posterior angles; narrow lateral blackish brown border, most strongly colored in anterior and posterior angles. Metathorax almost as wide as head, with flatly rounding posterior margin, with six hairs along each lateral third of this margin, a small transversal linear blackish blotch in anterior angle, and a larger lateral irregular curving blackish blotch in middle of lateral regions of segment. Legs with pale brown ground color, mostly tinged with translucent smoky brown and with darker marginal and annular markings.

Abdomen elongate, slender, subparallel-sided, not tapering posteriorly until segment 8 is reached; with short weak single hairs in posterior angles of segments and naked dorsal surface; pale ground color, with narrow, distinct, dark brown lateral bands and paler broad, rectangular transverse blotches, darker on posterior segments; a rather broad uncolored median longitudinal line; segment 1 with transverse blotch entirely across segment; segment 9 uncolored, narrowly notched, and with few long but weak hairs.

Male. Body, length 1.47 mm., width .4 mm.; head, length .33 mm., width .28 mm.; last abdominal segment protruding, narrowly rounded, with a pair of hairs (one longish, one short) on each side of the middle of the posterior margin; genitalia composed of narrow bars, and showing through in segments 8 and 9.

**Nirmus discocephalus** Nitzsch. (Plate lxvii, fig. 6.)

Germar's Mag. Entomol., 1818, vol. iii, p. 291.

*Nirmus discocephalus* Nitzsch, Burmeister, Handbuch d. Ent., 1835, vol. ii, p. 430; Denny, Monograph. Anoplur. Brit., 1842, p. 113, pl. ix, fig. 10; Giebel, Insecta Epizoa, 1874, p. 127, pl. vii, fig. 10; Piaget, Les Pediculines, 1880, p. 129, Supplement, 1885, p. 18, pl. ii, fig. 7.

My specimens, taken from a Bald Eagle, ***Haliæetus leucocephalus*** (Lawrence, Kansas), may be referred to this

Var. *amblys* Kellogg. Males, females, and young from the Bald Eagle, *Haliæetus leucocephalus* (Lawrence, Kansas). Male, body, length 1.56 mm., width .60 mm.; head, length .47 mm., width .46 mm. Female, body, length 2 mm., width .75 mm.; head, length .52 mm., width .53 mm. Characters of the species as described by Piaget (Supplement, 1885, p. 18, pl. ii, fig. 7), but with head not longer than wide, eyes with a hair, prothorax with a long hair in each posterior angle, metathorax with a spine in each lateral angle and six long hairs on each lateral fourth of the posterior margin.

**Nirmus fuscus** Nitzsch. (Plate lxvii, fig. 7.)

Zeitschr. f. ges. Naturwiss. (ed. Giebel) 1861, vol. xvii, pp. 523–525.
*Nirmus fuscus* N., Denny, Monograph. Anoplur. Brit., 1842, p. 118, pl. ix, fig. 8; Giebel, Insecta Epizoa, 1874, p. 123, pl. viii, fig. 2; Piaget, Les Pediculines, 1880, p. 130, pl. x, fig. 9.

Specimens of a large variety of this *Nirmus* of the Eagles and Hawks from Swainson's Hawk, *Buteo swainsoni;* from the Marsh Hawk, *Circus hudsonius;* and from the American Roughlegged Hawk, *Archibuteo lagopus sancti-johannis*—all from Lawrence, Kansas. The American form of *fuscus* (if it be not a new species, indeed) differs markedly from the European type or any of its rather many varieties by being much larger, my specimens being fully one-third larger than the *fuscus* specimens taken from *Buteo vulgaris* by Nitzsch and Piaget. If the various species of Giebel, *fuscus*, *stenorhynchus* and *leucopleurus* (Insecta Epizoa, pp. 124, 129), be only varieties of *fuscus* as Piaget believes (Les Pediculines, p. 131), then *fuscus* has been taken from *Buteo vulgaris*, *Milvus ætolius*, *Falco brachydactylus*, *Parus cærulens!*, *Aquila nævia*, *Circus rufus*, *Milvus ictinus*, *Ardea gularis!* (Piaget), *Archibuteo lagopus*, *Circus cyaneus*, *Circus æruginosus* and *Milvus regalis*. If in addition *rufus* N. with its numerous varieties belongs to the same species, nine or ten more hawk hosts should be enumerated. Without doubt this *Nirmus* type (elongate, with circumfasciate head, broad transverse median abdominal blotches, and distinct lateral bands with the segmental parts passing the sutures) is not yet at all understood. My specimens show the sharp, narrow emargination of the anterior margins of the first and second median abdominal blotches, which has been given as characteristic of *rufus* N. In size, however, the American specimens are distinct from any of the Old World members of the *fuscous* group. The female specimen I figure is from a Marsh Hawk, *Circus hudsonius*, and measures: Body, length 2.4 mm., width .62 mm.; head, length .6 mm., width .5 mm.

## LIPEURUS.

**Lipeurus introductus** n. sp. (Plate lxviii, figs. 1 and 5.)

Six females, two males, and an immature specimen from a Silver Pheasant, *Phasianus nycthemerus*, received by the Department of Zoology of this University from Mr. A. C. Robison of San Francisco. This Old World and because of numerous minor differences, such as the definite and characteristic number and arrangement of the long hairs of the metathorax, the presence of a hair on the temporal margins of the head, and the character of the genital blotch of the female.

Description of the female. Body, length 2.8 mm., width .66 mm.; colored and marked like *variabilis;* whitish, with distinct black lateral borders and chestnut median abdominal blotches concave on the sides.

Head, length .66 mm., width .5 mm.; in general like *variabilis*, but without ocular bands, or rather with large, subcircular ocular blotches in place of ocular bands (Giebel found merely "ein schwarzer Punkt" in *variabilis);* temporal margins not bare as in *variabilis*, but with a prickle behind the prominent eye, and a distinct hair and a prickle at the posterior angle.

Metathorax with a single long hair in the apex of the posterior angle, and just inside of this a white space with four long hairs (two in *variabilis).*

Abdomen not wholly bare except in angles, as Piaget's description of *variabilis* says, but with two longitudinal submedian rows of weak hairs, each in a small but distinct clear spot; the characteristic small triangular genital blotch of the female of *variabilis* is wanting, being replaced by a short, broad, oblong blotch which is united to the ventral segmental blotch preceding it, this segmental blotch being united also with the one preceding it.

Male. Body, length 2.5 mm., width .5 mm.; head, length .56 mm., width .4 mm.; with the strangely shaped head of *variabilis*, wider in front of the antennæ than across the temples; distinct black antennal bands, ocular blotches, and borders of posterior angles of temples running along posterior margin and terminating in a subcircular head; trabeculæ (wanting in female) peculiarly slender, finger-like; the great antennæ with large first segment with slender blunt horn-like appendage nearer the base than tip; third segment also appendaged. Metathorax with an additional long pustulated hair on posterior margin on each side, just inside of white space bearing four long hairs. Brown median abdominal blotches broader than in female, separated from the black lateral bands by a narrow whitish space; the strongly chitinized genitalia extending through segments 5–8; broadest in segment 5, tapering in segments 6–7, and uniform, narrow, two-pointed in segment 8.

**Lipeurus snodgrassi** n. sp. (Plate lxviii, fig. 2.)

A single female specimen of this strongly characterized *Lipeurus* from the Red-backed Rufous Hummingbird, *Trochilus rufous* (Palo Alto, California). This species resembles no other *Lipeurus* at all closely, though in the shape of the head and its peculiar length of forehead, in the short metathorax and heavy abdomen, there is suggested an affinity with *Lipeurus macrocephalus* Kellogg, taken from the Western Nighthawk, *Chordeiles virginianus henryi* (Palo Alto, California). See plate lxviii, fig. 3.

Description of female. Body, length 2.2 mm., width .56 mm.; whitish with sharp, black, rather broad lateral margins on head, thorax, and abdomen; abdomen with oblong, transverse, median, smoky brown blotches.

Head, length .55 mm., width .37 mm.; very long but not slender, and tapering but little; the forehead exceptionally long compared with hind head, the distance from antennæ to frontal margin being greater than from antennæ to occipital margin; front rounded, with lateral margins nearly parallel; suture obsolete; four short hairs on each side on the front or anterior part of lateral margin, and two short hairs in front of the short but distinct uncolored trabeculæ; antennæ rather long, slender; segment 2 longest and very slender, especially at base, segment 3 slightly longer than segment 4, and segment 5 slightly longer than segment 3, segments 3–5 colored, with uncolored distal extremities; eyes small, but slightly produced, and with a hair; temporal margins very slightly convex, with two long hairs; occipital margin straight, bare; lateral margins of forehead and hind head bordered with black, widest on temples, and with uneven inner margin on forehead; the lateral borders of forehead pass the anterior lateral angles but do not run clear across the front, although a clear, slightly colored, even chitin band borders the entire clypeal front; mandibles and œsophageal sclerite distinct, dark brown, and an occipital signature acutely pointed anteriorly showing through from under side.

Prothorox short, quadrangular (that part not covered by the head), with rounding posterior angles and straight posterior margin; without hairs; whitish, with broad black lateral borders. Metathorax short, but little longer than prothorax, broader than long, with diverging sides which are slightly concave anteriorly, and straight, bare, posterior margin; the posterior angles with five long hairs in two groups of two and three, rising from white spaces, the group of two hairs really situated on the outer part of posterior margin; segment white, with broad lateral borders which are widest in posterior angles and extend inward, tapering along the posterior margin, not reaching the middle of the segment; metasternum with a brown median blotch; legs whitish, with distinct blackish border on femora and tibiæ, and annulations on femora; coxæ almost wholly colored, and tarsi brown.

Abdomen elongate, subparallel-sided, with a few longish hairs on dorsal surface; whitish, with sharply marked lateral bands with short sharp irregular inward projecting processes; segment 3–6 with oblong, median, brown blotches, darker on segments 5–6 and not reaching the lateral bands; segment 8 with a narrow angulated or curving transversal black line connecting the lateral bands; segment 9 uncolored or whitish, angularly but not deeply emarginated.

**Lipeurus macrocephalus** n. sp. (Plate lxviii, fig. 3).

Many specimens taken from a Western Night Hawk, *Chordeiles virginianus henryi* (Palo Alto, Calif.). This species shows an affinity with *Lipeurus hypoleucus* N. (taken by Nitzsch in 1814 from *Caprimulgus europæus*, and first called by him *Nirmus concolor*, and then *N. hypoleucus*, under which name Giebel, Insecta Epizoa, p. 146, pl. viii, fig. 5, and Denny, Monograph. Anoplur, Brit., p. 141, pl. vi, fig. 8, refer to it; and finally correctly removed by Piaget, Supplement, p. 66, pl. vii, fig. 3, to *Lipeurus*) by the general outline, the hairs of the head, and the character of the thoracic segments. The new species differ from *hypoleucus* distinctly, especially in the shape of the head and the character of the signature. Oddly enough Piaget was unable to find a male one next to the most anterior being the longest; behind the suture two longer hairs; and rising from the base of the trabeculæ a long hair from the prominent eye, and two very long hairs and two prickles on the temporal margin; occipital margin flatly concave, nearly straight, bare; antennæ slender, all segments weakly colored, with uncolored tips; trabeculæ small but distinct, uncolored; brownish white, with signature and temples brown, and distinct occipital and interrupted antennal bands blackish brown; the signature is broad and short, obtusely angled behind, and shows a number of small whitish subcircular spots; internal bands (*i. e.* margins of the ventral furrow running anteriorly from the mouth) showing through faintly.

Prothorax quadrangular, a little broader than long, with slightly diverging sides, and straight, bare, posterior margin; no hair in posterior angles; ground color that of the head, with narrow uncolored median longitudinal line forking at anterior end; broad dark rusty brown lateral borders. Metathorax but little longer than prothorax, with diverging sides; lateral margins with a slight but distinct rounding concavity near anterior end; posterior margin straight; posterior angles with three longish hairs, and a group of two on posterior margin near the angle; these two and two of the three in angle pustulated; ground color of segment same as or slightly darker than prothorax, with uncolored median longitudinal line, and lateral irregular dark brown lateral borders, narrower than those of prothorax. Legs long, coxæ elongate, brown, with whitish distal ends; femora and tibiæ concolorous with pale ground color of thorax, with rusty brown marginal markings. Sternal markings composed of rather short, broad intercoxal lines between pro- and meso-legs, connecting with a short, narrow transverse median blotch; on metasternum oblong intercoxal blotches, and a large median blotch longer than wide and pointed posteriorly.

Abdomen elongate, subparallel-sided; segments 1, 7 and 8 short; segment 9 very short; posterior angles of segments with a series of five longish fine hairs arising from very small but distinct pustulations near the posterior margin of each segment; beyond this series at each end and near the posterior margin a longer, stronger hair on larger pustulation; all segments except segment 9 with a broad chestnut brown transverse blotch covering all of the segment; stigmatal spots clear; narrow dark rusty brown lateral bands; sutures uncolored; segment 9 uncolored, with two faint brownish lateral blotches, weakly angularly concave behind, without hairs, except two very short prickles, one on each half of posterior margin,

**Lipeurus baculus** Nitzsch. (Plate lxviii, figs. 4 and 6.)

Germar's Mag. Entomol., 1818, vol. iii, p. 293.

*Pulex columbæ majoris* Redi, Opusculorum pars I, sive experimenta circa generationem Insectorum, 1686, pl. ii; Albin, Nat. Hist. Spiders and Other Curious Insects, 1736, pl. xliii.; Schrank, Enumeratio Insectorum Austriæ, 1781; Geoffrey, Hist. abrégée des Insectes, 1762, vol. ii, p. 599.

*Pediculus columbæ* Linne, Systema Natura, 1767; Fabricius, Systema Entomologiæ, 1775.

*Lipeurus bacillus* Nitzsch (ed. Giebel) Zeit. f. ges. Naturwiss., 1861, vol. xviii, p. 305; Giebel, Insecta Epizoa, 1874, p. 215, pl. xvi, figs. 8, 9; pl. xx, fig. 3.

*Lipeurus antennatus* Giebel, Insecta Epizoa, 1874, p. 213.

*Lipeurus angustus* Rudow, Zeitschr. f. ges. Naturwiss., 1870, vol. xxxvi, p. 137.

Specimens of this long known parasite of doves and pigeons taken from a domestic pigeon, *Columba livia*. I follow Piaget and Taschenberg in their refusal to recognize as species the numerous variants observed. The definition of this species presents a case similar to that presented by *Lipeurus squalidus* (see discussion of *squalidus)*.

I figure the female and head of male, not alone for the convenience of American students, but because the previously published figures of this species are faulty. Piaget figures the male. Osborn's figure, undoubtedly well drawn, is spoiled in the printing. Piaget is in error in attempting to correct Giebel's statement that there are four small clavate appendages on the frontal part of the clypeus. Piaget declares there are but two such appendages; in my specimens there are distinctly four. The female specimen figured by me measures: body, length 2.5 mm., width .37 mm.; head, length .42 mm., width .28 mm.

**Lipeurus dissimilis** Piaget. (Plate lxviii, fig. 7.)

Les Pediculines, 1880, p. 359, pl. xxix, fig. 1.

Two specimens, one immature, from a Bob-white *Colinus virginianus* (Lawrence, Kansas). Piaget described the species from specimens taken from the same bird species in the Zoological Garden of Rotterdam. My specimens differ from Piaget's description in some particulars. Piaget says, "l'œil nu;" my specimens have a distinct longish hair in the eye; the lateral bands of the abdomen distinctly pass the suture in my mature specimen: Piaget says that the bands do not pass the sutures.

The species may be recognized by its general similarity in form and appearance to *Lipeurus docophoroides* Piaget, of the California Quail (see pl. lxviii, fig. 8). *Dissimilis* differs from *docophoroides* in having the head more rounded in front, the abdomen longer and broader, and in the absence of pustulations at the bases of the hairs. My specimen (mature) measures: Body, length 2.4 mm., width 1.03 mm.; head, length .6 mm., width .53 mm.

**Lipeurus docophoroides** Piaget. (Plate lxviii, fig. 8.)

Les Pediculines, 1880, p. 357, pl. xxviii, fig. 9.

Two female specimens of this striking *Lipeurus*, taken from a California Partridge, *Callipepla californica* (Mountain View, California). Piaget found his specimens on individuals of the same bird species in the Zoological Garden of Rotterdam. The species is a transition form between *Docophorus* and *Lipeurus*. Piaget says of it: "La forme du thorax, des pattes en général et de l'abdomen, la presence des trabécules indiquent une transition au genre *Docophorus*; l'antenne, la fossette, l'implanta-

## GONIODES.

**Goniodes cervinicornis** Giebel. (Plate lxix, fig. 1.)

Insecta Epizoa, 1874, p. 199.

*Goniodes cervinicornis* G., Piaget, Les Pediculines, 1880, p. 272, pl. xxii, fig. 6.

Numerous specimens from a Silver Pheasant, *Phasianus nycthemerus*, sent to the Department of Zoology of this University by Mr. A. C. Robison of San Francisco, Calif. This large and striking *Goniodes* of the pheasants (Giebel's specimens were found by Kollar on *Phasianus nycthemerus*, and Piaget has found it abundantly on *Tragopan satyrus*) is characterized by the peculiar bipartite appendage on the first segment of the antenna of the male. It may be readily recognized by comparison with the figure of the female which I give. My specimens measure; Male: Body, length 3.34 mm., width 2 mm.; head, length .9 mm., width 1.32 mm. Female: Body, length 3.75 mm., width 2. mm.; head, length 1.03 mm., width 1.34 mm. These measurements are markedly greater than those given by Piaget; his male specimens averaging 2.75 mm. long, and the females 3.1 mm. long.

**Goniodes mammillatus** Rudow. (Plate lxix, fig. 2.)

Zeitsch. f. d. ges. Naturwiss., 1870, vol. xxxv, p. 483.

*Goniodes mammillatus Rudow*, Taschenberg, Die Mallophagen, 1882, p. 25, pl. i, figs. 1, 1a, 1b.

Two females from a California Partridge, *Callipepla californica* (Mountain View, California). This striking species was first described by Rudow from a specimen taken from *Pelecanus ruficollis!* (a dried skin in some museum). Taschenberg, who collected a number of specimens from *Callipepla californica* (skins?), says: "Wenn die Art wirklick wie Rudow angiebt, auf *Pelecanus ruficollis* angetroffen ist, so ist es in Folge zufälliger

Uebertragung geschehen." The species may be recognized by the broad abdomen and the striking angulated lateral bands of the abdomen, each segmental portion projecting diagonally forward and inward and ending in an indistinctly limited paling brown blotch. Taschenberg says that the head of the male is a little longer than broad, with deep emarginations at the bases of the antennæ, and with strongly angulated temporal margins between which the head is a little narrower than it is just in front of the antennæ. The female figured by me measures as follows: Body, length 2.25 mm., width 1.16 mm.; head, length .62 mm., width .72 mm.

## GONIOCOTES.

**Goniocotes creber** n. sp. (Plate lxix, fig. 3.)

An extraordinary number of specimens on a Silver Pheasant, *Phasianus nycthemerus*, presented to the Department of Zoology of this University, by Mr. A. C. Robison of San Francisco. In addition to the great number of individuals of this *Goniocotes* on the bird, there were present in more than ordinary numbers the giant *Goniodes cervinicornis*, *Lipeurus introductus* n. sp. and *Menopon monostæchum* n. sp. The short feathers

Head, length .44 mm., width .6 mm.; front broad, convex, with ten short prickles; antennæ in a shallow emargination with second segment longest and the fifth longer than third or fourth, which are about equal; eye prominent, with a prickle; the slightly protruding, rounded temporal margins with a prickle and two strong hairs; posterior margin concave in middle, with obtuse angles at each end of the concavity; head brownish, with darker narrow marginal frontal bands ending posteriorly on each side in an expanded darker spot inside of antennal emargination; mandibles and œsophageal sclerite dark brown; an irregular brown ocular blotch and a sinuous dark brown occipital border along the concave curve of the occipital margin.

Prothorax very narrow, short, trapezodial, with lateral margins converging anteriorly, and posterior margins flatly convex; the latero-posterior angles are slightly produced and acute, and each bears a strong hair; indistinct brownish lateral borders. Metathorax with blunt lateral angles, each with two strong hairs; posterior margin obtusely angled on abdomen, and bare except for two hairs near the lateral angles. Legs concolorous with body, with dorsal marginal markings and some scattered spines.

Abdomen broadly elliptical; posterior angles of segments projecting and bearing, except on segment 1, one to three rather short, strong, finely pointed hairs; segment 1 longest at sides but short in middle because of the backward projecting angulated thorax; middle region of abdomen pale to uncolored, faint lateral transverse blotches and conspicuous lateral bands, which on all segments except segment 1 are curved so as to enclose a small uncolored space; the curved band projects inward and forward, passing the suture; the last segment hairs. The posterior margin of the metathorax is angulated and the angle projects so far backward that it nearly cuts the first abdominal segment in two. Professor Osborn's figure'is faulty in representing the metathorax with straight posterior margin. The male figured by me measures: Body, length 1.06 mm., width .48 mm.; head, length .34 mm., width .37 mm.

## PHYSOSTOMUM.

**Physostomum microcephalum** n. sp. (Plate lxx, fig. 1.)

A single female from the House Finch, *Carpodacus mexicanus frontalis* (Palo Alto, California). Not common on its host, as I have a record of twelve other individuals of *Carpodacus* from which Mallophaga were taken, but on none of them was this *Physostomum* again found. The new species approaches the general type of *P. agonum* N. (Giebel, Insecta Epizoa, p. 255), from *Sylvia rubecula* and *S. suecia* more nearly than it approaches any other of the Old World species.

Description of female. Body, length 3.6 mm., width 1.25 mm.; head small; abdomen large and exceptionally broad; head markings pale, ill-defined; distinct brown lateral bands; paler colored large median transverse abdominal blotches.

Head, length .66 mm., width .72 mm., thus being wider then long, which is exceptional in *Physostomum*, and being especially small in proportion to the size of the whole body; front flatly rounded, and sides of forehead weakly concave; prickles on front, one hair on margin at extremity of transverse clypeal suture, and a few very short hairs and two longer ones along margin before the eye; eye distinct, with a black fleck; palpi passing the margins of head; the blunt lateral flaps slightly passing the margin; temples not produced very far backward, with a little narrowed tip at the apex of the posterior angle; temporal margins with three longish hairs and a few short ones: markings weakly colored, a pale chestnut brown.

Prothorax, with distinct lateral angles, in apex of which a spine and a long hair; another long hair near rounded posterior angle, and two spines on margin in front of lateral angle; segment whitish, with faint brownish tinges on lateral borders and elsewhere. Metathorax with weak concavity on lateral margins in front of the middle; two hairs in the posterior angles, and some scattered short spines on margin and dorsal surface of anterior half (mesothorax) of segment: color of prothorax, with brown lateral borders narrowing anteriorly. Legs concolorous with thorax, with narrow darker marginal color.

Abdomen large, expanding in the middle half, and broad and bluntly rounded behind; not very long single hairs in the posterior angles, and on the dorsal surface just inside of the colored lateral bands a double longitudinal row of weak hairs: whitish, with distinct brown lateral bands and large oblong median abdominal blotches, darkest on segments 5 and 6.

**Physostomum sucinaceum** n. sp. (Plate lxx, fig. 2.)

clypeus clear, almost uncolored; head markings dark brown, but not very sharp; eye with black fleck.

Prothorax with almost no lateral angles, the angles being very obtuse and flattened; two spines and a long hair in the angles and another long hair near the posterior angle; posterior margin of segment concave; a brownish submarginal lateral border. Metathorax with a few small spines along lateral margins, and a longish hair near posterior angles. Legs whitish, paler than body color.

Abdomen with sides only flatly convex, subparallel; single hairs on posterior angles of segments and a longitudinal row of small hairs, one on each segment, on each side inside of the lateral band; lateral bands pale amber brown, not much darker than ground color of body; faint median transverse blotches, apparently nearly square.

**Physostomum angulatum** n. sp. (Plate lxx, fig. 5.)

Two females taken from a Kingbird, *Tyrannus tyrannus* (Lawrence, Kansas), and one female from a Fox Sparrow, *Passerella iliaca* (Lawrence, Kansas).

Description of female. Body, length 5. mm., width 1.3 mm.; pale golden, with narrow dark brown lateral bands on abdomen and thorax, and few dark brown head markings; the largest *Physostomum* yet found.

Head, length 1 mm., width .94 mm.; front flatly convex, without marginal hairs, sides with two short hairs on dorsal surface near and projecting over the margin even with base of antennæ, and at same place two similar submarginal ventral hairs, and two shorter hairs on margin in the very slight ocular emargination; occipital angles acute and much produced posteriorly (extending nearly to middle of prothorax), bearing three long hairs; occipital margin is thus very concave and is without hairs; palpi projecting beyond margin by half of last segment;

labral lobes inconspicuous, not projecting beyond margin of head; a distinct, curved, dark brown blotch bounding inner margin of antennal fossa; in front of it two paler blotches, the anterior being the larger, and a narrow dark brown occipital border; the rest of head concolorous with the body or paler.

Prothorax hexagonal, the angles rounded, the lateral angles with a longish weak hair and a spine; a distinct, brown, submarginal border laterally, which turns inward at its anterior end and is looped. Metathorax longer than prothorax, with gently sinuous sides, without distinct marginal hairs (a short projecting hair or spine near the posterior angle is not strictly marginal); posterior margin straight: anterior angles with irregular brown blotch, a linear, diagonal blotch on each side near middle, and submarginal lateral bands continuous with those of the abdomen. Legs long, slender, concolorous with the body.

Abdomen elongate-elliptical, truncate anteriorly, with sharply marked dark brown to black submarginal lateral bands composed of segmental parts separated by diagonal sutures and slightly laterally displaced; posterior angles of segments with one or two weak hairs; vulva convex.

Head, length .68 mm., width .7 mm.; front narrow, flatly convex, without hairs; sides with a distinct rounding emargination even with the mouth parts; ocular emargination filled by the conspicuous eye; occipital angles not so acute as in *angulatum*, but projecting backwards nearly to lateral angles of prothorax, and with three longish hairs. Markings similar in position to those of *angulatum* but more pronounced; antennal fossa entirely rimmed and connected with occipital border by a short occipital band; in front of the antennal fossa three blotches (instead of two as in *angulatum*), the most anterior being a short band projecting inward from the lateral margin.

Prothorax with the constriction in front of lateral angles especially marked and the angles with one or two spines but no hair; general color of the segment golden brown, with black submarginal lateral bands. Metathorax with a rounded swelling on anterior third of sides, without marginal hairs and with markings resembling those of *angulatum*, viz., irregular black blotches in anterior angles, submarginal lateral bands continuous with those of abdomen, and two short linear blotches lying inside of the lateral bands which are in this species entirely disconnected from the bands and are but slightly diagonal. Legs pale with distinct narrow black margins on femora and indistinct narrower tibial margins.

Abdomen; segments with one long hair on lateral margin near posterior angle; posterior margin of last segment with hairs composing the delicate fringe unusually long; uncolored to pale golden, with uniform submarginal lateral black bands (more nearly continuous than in *angulatum*, the diagonal sutures and lateral diplacement of the various segmental portions being less marked);

on segments 1–7 a pale brown median blotch, the blotches on segments 4–5 being larger; vulva convex.

**Physostomum diffusum** n. sp. (Plate lxx, fig. 3.)

One female taken on the Sandwich Sparrow, *Passerculus sandvicensis*, and several males and females taken on the Golden Crown Sparrow, *Zonotrichia coronata* (near Stanford University, Calif.); also two females and a young specimen (variety *pallidum* Kellogg) from a *Junco* sp. (Lawrence, Kansas). This species differs from the preceding two species described in having the lateral abdominal bands distinctly marginal (as is the case with the species of Piaget, Nitzsch, and Denny), and in this it resembles the European species. It has the very long, backward-projecting, occipital angles, as in *angulatum* and *australe*, which is a character shown by but few of the European forms.

Description of female. Body, length 4 mm., width 1.09 mm.; white, with dark brown to black marginal lateral bands on abdomen and thorax, and few black head-markings; the labral lobes large and projecting.

Head, length .8 mm., width .7 mm.; front rather broad, flatly convex, without marginal hairs, sides nearly straight smoky, occipital margin, indications of occipital bands, and a narrow, indistinct smoky margining of the temples.

Prothorax hexagonal, with anterior and posterior margins weakly concave; in the obtuse lateral angles a hair and two spines; segment white with a narrow submarginal black band, the margin outside of it being more or less suffused with smoky brown. Metathorax with a slight lateral swelling on the lateral margin near the anterior end, bearing a few short pale brown spines; in the posterior angles a single, longish, weak hair; segment white, with a narrow, submarginal, lateral band, outside of which on posterior half of segment the margin is smoky brown. Sternal markings consisting of an intercoxal line, long and curving forward, on metasternum, and two faint median lines on prosternum. Legs, white.

Abdomen. Posterior angles with a single longish hair and a shorter weaker one on lateral margin of each segment of segments 5–8; last segment flatly rounded with two pairs of hairs, and the posterior fringe distinct; dorsal surface without hairs, or with very few; segments white, with broad, black, marginal, lateral bands fading out on eighth segment; indications of narrow, transverse, linear, median blotches at the sutures; under side of abdomen with pale brown, median blotches on segments 5–6.

Var. *pallidum* Kellogg. Two females and a young specimen taken from a *Junco* sp. (Lawrence, Kansas) may be referred to this species but they show varietal differences. The body color is pale golden, the markings are brown, not black, and the middle region of the whole abdomen is pale brownish; of the head markings only the ocular fleck and the bounding blotch on inner rim of the antennal fossa are distinct.

## Colpocephalum.

**Colpocephalum chrysophæum** n. sp. (Plate lxxi, fig. 1.)

Found on three out of seven specimens of Samuels' Long Sparrow, *Melospiza fasciata samuelis* (Palo Alto, California).

Description of female. Body, length 1.35 mm., width .7 mm.: golden brown with blackish brown bands and margins, and rusty brown transverse blotches.

Head, length .28 mm., width .5 mm.; broadly parabolic in front: one short hair on each side of the middle, then a longer one, then a short one, then a very long one, then two longish ones: the palpi project by at least the last two segments: the ocular emargination is distinct but not acute inwardly: the eye is large, emarginate, and with a distinct black fleck; ocular fringe distinct; temples projecting, rounded, rather narrow, with several long hairs of different lengths, of which two are very long and equal: on the occipital margin of the temples another very long hair and two or three shorter ones; middle part of occipital margin with a few long hairs; head tinged with fuscus with black, curving, broadly linear, ocular especially narrow and distinct, and the curving longitudinal lines beyond the ends are sharply defined and black. Metathorax with posterior margin straight and with about ten longish weak hairs ranged along it; darkest along the short anterior margin and in the latero-posterior angles. Legs pale, with sharply defined marginal markings, especially on the coxæ and on the long slender tibiæ of middle and hind legs. Sternal markings consisting of a small median triangle with linear wings on prothorax, and of black, distinct, angulated, intercoxal lines between meso- and meta-coxæ.

Abdomen ovate, broad at both ends; long hairs in posterior angles of segments, and short hairs, not numerous, on dorsal surface; all segments with a broad, brown, transverse blotch extending entirely across segment, covering almost the whole surface; the sutures, however, are broad and uncolored; lateral bands narrow, black, fading inwardly into the transverse blotches; last segment broad, flatly convex behind, with a fringe of short hairs.

Male. Body, length 1.09 mm., width .5 mm.; head, length .25 mm., width .4 mm.; conspicuously smaller than the female; genitalia extending through segments 5–9, in shape a heavy two-pronged fork.

**Colpocephalum osborni** n. sp. (Plate lxxi, figs. 2 and 3).

Many specimens, males, females and young, from a White-tailed Kite, *Elanus glaucus* (Palo Alto, California), resembling *C. dissimile* Piaget (Les Pediculines, p. 520, pl. xliii, fig. 4), taken from *Milvus ægyptius* (Museum of Leyden), and *C. tricinctum* Nitzsch (Giebel, Insecta Epizoa, p. 263), taken from *Milvus ater*. Named for Prof. Herbert Osborn of Iowa, who has contributed to the knowledge of American Mallophaga.

Description of male. Body, length 1.31 mm., width

.5 mm.; golden brown, with distinct, broad, black, occipital bands with expanded extremities, and dark brown, transverse, abdominal blotches with black lateral ends.

Head, length .31 mm., width .5 mm.; rather large compared with whole body, just as wide as widest part of abdomen; front broad, flatly rounded, with seven hairs on each side of the median line, four of which are grouped together in front of the ocular emargination; last segment of antenna broad, with slightly concave terminal margin projecting beyond margin of head; ocular emargination pronounced, the deepest point being acutely angled; an ocular fringe; swelling rounded temporal margins, with several hairs of different lengths, three being about equal and longest; occipital margin concave, with four hairs; golden brown, with large black subcircular ocular blotches and triangular occipital blotches connected by the broad, paler (reddish brown) occipital bands; the occipital blotches connected by an even, strongly colored, broad, occipital border; clypeus with two blackish brown blotches connected with the ocular blotches and mandibles by colored areas but little darker than the ground color of head.

broad, transverse, dark chestnut-brown blotch entirely across segment, darkest laterally, with sharp black angulated lateral bands, especially noticeable on segments 3–8; last segment without noticeable blotch, bluntly rounded behind, without numerous hairs.

Female. Body, length 1.47 mm., width .63 mm.; head, length .3 mm., width .5 mm.; with abdomen obovate, tapering posteriorly; abdominal blotches darker laterally but paler in the middle; lateral bands not angulated and wider; last abdominal segment elongate, tapering, with narrow flatly convex posterior margin; segment 8 with a group of seven strong curving hooklike hairs, the posterior ones longest, situated on posterior part of lateral margin of segments; posterior margin of this segment with a series of closely set hairs.

**Colpocephalum fumidum** n. sp. (Plate lxxi, fig. 5.)

A single specimen from a Least Bushtit, *Psaltriparus minimus* (Palo Alto, California). A strikingly dark *Colpocephalum* showing resemblance to some of the *Colpocephali* of the water birds, such as *uniseriatim* Piaget (Les Pediculines, p. 562, pl. xlvii, fig. 2), from an Avocet, *Recurvirostra avocetta*, rather than to any of the few *Colpocephali* hitherto described from passerine birds.

Description of female. Body, length 2.75 mm., width 1.1 mm.; very dark, smoky, with black occipital margin, ocular blotches, and blackish lateral abdominal bands.

Head, length .5 mm., width .75 mm.; forehead large, flatly rounded in front, with numerous short hairs; two longer hairs in angle in front of ocular emargination; the ocular emargination pronounced, angulated, with the anterior margin of the produced temples almost at right angles to the long axis of the head; the eye prominent, almost if not quite divided, the anterior and larger part lying in the angle of the emargination, the smaller and posterior part lying apparently on the dorsal surface of the temple; ocular fringe distinct, composed of longish hairs; temporal margins with slightly rounded anterior and posterior angles, and slightly convex lateral margin which bears five longish hairs; occipital margin weakly sinuous and concave, with four hairs; fuliginous with black uneven occipital border; small black ocular blotches, and four small circular uncolored spots on forehead, from each of which arise one or more hairs.

Prothorax with bluntly rounded lateral angles, slightly concave latero-posterior margins, and convex posterior margin, the segment produced backward so as to very materially narrow the median part of the mesothorax, with a spine and a long hair in the lateral angles and two separated hairs on the concave lateral margins, the anterior hair being short and weak. Mesothorax separated from metathorax by an uncolored suture, but with extremely slight lateral emargination; no hairs. Metathorax larger than mesothorax, with straight posterior margin, a spine, a weak hair and a strong hair in posterior angles, and posterior margin not with a marginal series

**Colpocephalum flavescens** Nitzsch. (Plate lxxi, fig. 4.)
Germar's Mag. Entomol., 1818, vol. iii, p. 298.

*Colpocephalum flavescens* N., Nitzsch (ed. Giebel) Zeitschr. f. ges. Naturwiss, 1861, vol. xvii, p. 522; Burmeister, Handb. d. Ent., 1835, vol. ii, p. 438; Denny, Monograph., Anoplur. Brit., 1842, p. 206, pl. xviii, fig. 2; Giebel, Insecta Epizoa, 1874, p. 262, pl. xiii, fig. 10; Piaget, Les Pediculines, 1880, p. 515, pl. xlii, fig. 10.

Specimens which should probably he referred to this species from two Bald Eagles, *Haliæetus leucocephalus*, and an American Rough-legged Hawk, *Archibuteo lagopus sancti-johannis* (Lawrence, Kansas). The male figured by me measures: Body, length, 1.5 mm., width, .6 mm.; head, length .31 mm., width .53 mm. The species may be recognized by the strong distinct blotches and occipital bands and border of the head, and the transversal abdominal blotches.

**Colpocephalum subæquale** Nitzsch. (Plate lxxii, fig. 1.)
Germar's Mag. Entomol., 1818, vol. iii, p. 299.

*Colpocephalum subæquale* N., Burmeister, Handb. d. Ent., 1835, vol. ii, p. 438; Giebel, Insecta Epizoa, 1874, p. 265, pl. xiii, figs. 13 and 14, Piaget, Les Pediculines, 1880, p. 527.

Two females from an American Crow, *Corvus americanus* (Palo Alto, California). I did not find this species represented on several other crows shot at Palo Alto and at Lawrence, Kansas, although all of the individuals were infested by other parasites, such as *Docophorus atratus* or *Menopon mesoleucum*. My specimens do not have the dorsal surface of the thoracic segments with scattered long hairs, nor the surface of the abdomen thickly beset with hairs, as Giebel's description (Insecta Epizoa, p. 265) records; but neither are these hairs shown in Nitzsch's figure. Nitzsch's specimens were found on *Corvus corax* and *C. frugilegus*. My specimens do not have the first two segments of the abdomen especially lengthened as in Rudow's *semicinctum* (Zeitschr. f.

ges. Naturwiss., 1869, vol. xxxiv, p. 394), from *Corvus scapulatus*. The species may be recognized by the broad black occipital border and occipital bands, ocular and frontal blotches of the head, and by the transverse abdominal blotches of the abdomen, much narrowed in the middle in the male, and divided in the female into a median and two lateral parts. The female figured by me measures: Body, length 1.53 mm., width .63 mm.; head, length .31 mm., width .5 mm.

**Menopon decoratum** n. sp. (Plate lxxii, fig. 2.)

One male, one female, and a young specimen from a White-tailed Kite, *Elanus leucurus* (Palo Alto, California). A finely marked species not resembling especially any other *Menopon* hitherto taken from birds of prey. No *Menopon* has heretofore been taken from a Kite.

Description of male. Body, length 1.53 mm., width 72 mm.; pale yellowish brown, with dark rusty brown to black markings; distinct transverse bars on abdominal segments, the one on segment 2 especially strongly defined.

Head, length .31 mm., width .66 mm.; robust, more than twice as wide as long; front broad, flatly rounded, Prothorax irregularly hexagonal, with obtuse lateral angles, and posterior margin flatly convex, with a very obtuse median angle; lateral angles with one very long hair and one shorter one, and a series of eight strong hairs along posterior margin, the terminal hair at each end of the series being exactly in the latero-posterior angle; chitinized tranverse bar in anterior part of segment is weakly colored, and the longitudinal bars at its end are indistinct. Metathorax as short as or slightly shorter than prothorax, wider, with posterior margin straight; two long hairs in posterior angles, and a series of shorter weak ones along posterior margin; anterior angles with strongly colored blotch; an ill-defined, short longitudinal blotch projecting back from converging lateral margins. Legs palely colored.

Abdomen broadly ovate, wide and flat behind; posterior angles of segments with two usually long hairs and several short ones; single series of hairs not numerous on dorsal surface; lateral bands blackish brown, broad, interrupted, the segmental portions projecting inward; dark chestnut brown transverse blotches across the segments, with the pale or uncolored sutural bands broad; the colored transverse band of segment 2 is specially strongly marked, and is rather sinuous; last segment with broad, uncolored, posterior border, and with posterior margin straight, with a slight median emargination, and a sparse fringe of hairs of different lengths.

Female. Body, length 2. mm., width .94 mm.; head, length .4 mm., width .7 mm.: perhaps a little darker; the transverse blotches of abdomen better defined; last abdominal segment narrower than in male, and the posterior margin broadly parabolic, with few long, and numerous short hairs.

**Menopon robustum** n. sp. (Plate lxxii, fig. 3.)

A single specimen found on a Least Bush Tit, *Psaltriparus minimus* (Palo Alto, Calif.). No other specimens of this strange species were found on five other individuals of the same bird species examined. I refer the species to the genus *Menopon*, for it is evidently more closely allied to this genus than to any other one so far established. But it presents a mingling of characters of *Menopon*, *Ancistrona* and *Eureum;* a short broad head with strongly chitinized backward-projecting processes on the ventral surface like *Ancistrona;* a thorax like *Eureum*, and the habitus and general body characters of *Menopon*. If it is to be referred to *Menopon* it ranks with *titan* and *tridens* as anomalous members of the genus, which should be distinguished by subgeneric names, or which should be the provocation for breaking up the already unwieldy genus into several genera. In general shape it resembles *M. subrotundum*, Piaget (Les Pediculines, p. 453, pl. xxxv, fig. 2), from *Gracula sulcirostris*.

Description of the female. Body, length 1.43 mm., width .85 mm.; being thus very broad and short; smoky divided, and with a distinct fleck; the narrow produced temples with five long hairs of which the hindmost three are very long; occipital margin with six hairs, the two outer ones arising submarginally, no distinct head bands or blotches; the occipital margin narrowly bordered with black; on the under side of the head there are two strongly chitinized, backward-projecting, pointed processes arising from the labium (resembling those, but not bipartite, of *Ancistrona*); these processes show through above and give an appearance of faint occipital bands.

Prothorax very large, as long as the head, and three-fourths as broad, with strong, produced, obtuse, lateral angles; posterior margin obtusely angled on the metathorax; a strong spine and a long hair in each lateral angle, and a not well filled series of weak hairs along posterior margin; the transverse chitin bar distinct, blackish brown, and the curving longitudinal chitin bars at its ends distinct, blackish; no well defined blotches. Metathorax with a few small spines along lateral margins and two longish hairs in posterior angles; posterior margin with marginal series of short hairs (like those of abdomen); regions of latero-posterior angles dark brown, the color extending forward narrowly along the lateral margins. Sternal markings composed of a small median blotch on prothorax, with posterior produced point and lateral linear processes; curving intercoxal lines on mesothorax and short straight ones on metathorax, with a broad pale colored median blotch. Legs concolorous with head and thorax, with coxæ distinctly margined with blackish brown; anterior coxæ with blunt processes about as long as but narrower than the coxæ themselves.

Abdomen more golden or yellowish brown than head and thorax; very broadly elliptical; but slightly turbinated; with two or three rather short hairs in posterior angles; a single transverse series of short hairs along posterior margin of each segment; broad, transverse bands entirely covering each segment; darker at lateral margin, especially on anterior segments; last segment flatly rounded, with fringe of short hairs.

**Menopon monostœchum** n. sp. (Plate lxxii, fig. 4.)

Specimens from a Silver Pheasant, *Phasianus nycthemerus*, received by the zoological department of this University from Mr. A. C. Robison of San Francisco, California.

The species is like *subæquale*, Piaget (Les Pediculines, p. 463, pl. xxxvii, fig. 5), from *Euplocamus ignitus* in shape of thorax and body, but has only single series of hairs on the abdominal segments (*subæqualæ* has two series on each segment); in the matter of the hairs of the body the new species is like *uniseriatim*, Piaget (Les Pediculines, p. 464, pl. xxxviii, fig. 4) from *Phasianus prælatus*, but differs from this species in not having the posterior margin or prothorax projecting backward and angulated; in both *subæqualæ* and *uniseriatim* the females are smaller than the males (according to Piaget), which unusual condition does not obtain in the new species.

brown ocular blotch; occipital margin narrowly edged with brown; mandibles and adjacent lateral regions dark chestnut brown.

Prothorax with lateral angles narrowly rounded, and with a longish spine; posterior margin curving at sides, but nearly straight on metathorax, and with a marginal series of strong, long hairs; transverse chitin bar pale to uncolored, but distinct, as also the longitudinal bar at its ends. Metathorax of about same length as prothorax, and but very little if at all wider; with five strong, short spines along each lateral margin, and a series of hairs along the straight posterior margin; lateral margins narrowly bordered with blackish brown, and linear brown blotches projecting backward from anterior angles, and tapering and fading out posteriorly. Legs pale, concolorous with body.

Abdomen elliptical, with segments projecting but little laterally; posterior angles with several hairs of different lengths, the hairs longer on posterior segments until on segments 8–9 some of them are very long; lateral bands with short processes projecting inward, one in middle of lateral margin of each segment and one along each suture; no transverse blotches, or only faint indications of brownish color; last segment broad, rounded behind, with numerous long hairs.

Female. Body, length 2.3 mm., width .9 mm.; head, length .4 mm., width .72 mm.; last segment of abdomen more flatly rounded, with a tuft of hair at each posterior angle and a fringe of hairs of equal size along the posterior margin, giving the tip of abdomen a truncate appearance.

**Menopon melanorum** n. sp. (Plate lxxiii, fig. 1.)

Taken on a Towhee, *Pipilo erythrophthalmus* (Lawrence, Kansas).

Description of female. Body, length 1.37 mm., width .56 mm.; pale golden brown, with black occipital margin of head, blackish brown ocular blotches and mandibles, and brown transverse abdominal blotches distinct only laterally.

Head, length .31 mm., width .47 mm., rather long in comparison with its width for *Menopon;* front rounded, with usual few short hairs in front of barely projecting palpi, and two longish ones in front of ocular emarginations; the emargination distinct, shallow, and with ocular fringe; temples broad, rounded, with a few hairs of different lengths, including at least one very long hair; occipital margin concave, straight in middle, with two longish and two short hairs; occipital margin narrowly but conspicuously bordered with black; indications of widely separated, translucent, occipital bands, convex outwardly; ocular blotches small, narrow, linear, curving, blackish in middle, paling at each end; a small black ocular fleck; a brown spot on margin outside of each of body. Legs concolorous with thorax, with darker indistinct marginal and terminal margins.

Abdomen short, broad, ovate, not turbinated; a single very long hair and a spine in posterior angles of segments; broad, pale brown, transverse bands across all segments but the last, these bands, however, hardly apparent on the middle region of the body, but distinct laterally, the lines of demarcation between pale and darker parts of band rather sharply defined; last segment broad, flatly rounded, uncolored, with a fine fringe of short, uncolored hairs.

**Menopon incertum** n. sp. (Plate lxxiii, fig. 2.)

Specimens from an American Gold Finch, *Spinus tristis*, and from a Russet-backed Thrush, *Turdus ustulatus* (Palo Alto, California). This is one of these species which might be referred almost indifferently to *Menopon* or to *Colpocephalum*. Because Giebel has referred to a somewhat similar form, *thoracicum* (Insecta Epizoa p. 287) from *Turdus viscivorous*, to *Menopon*, I assign this species to the same genus. The new species differs from *thoracicum* in the hairs of the prothorax, in the straight, not angulated, posterior margin of the mesothorax, in lacking a complete series of hairs along the posterior margin of the metathorax, in the presence of the characteristic spines of the posterior angles of the abdominal segments, and in other particulars. The ocular emarginations of the head are distinct, "fast colpocephalisch," as Giebel says of *thoracicum*.

Description of the male. Body, length 1.16 mm., width .48 mm.; pale brown, with distinct, broad, dark brown, transverse, abdominal bands, and blackish lateral bands; head two-thirds as long as wide.

Head, length .28 mm., width .44 mm.; rather elongate for *Menopon*, with distinct ocular emarginations; rounded in front, with a few short hairs; two longer hairs (one longer than the other) in front of emargination; ocular fringe distinct; temporal margin with four long hairs, of which two are very long, and a few shorter hairs; occipital margin concave, straight in the middle; palpi projecting slightly; occipital margin narrowly bordered with black; temples clouded; a curving, blackish brown, ocular blotch, and in front of its anterior end a small, blackish brown, submarginal blotch.

Prothorax short, broad, the lateral angle being but little produced, with two short strong spines and no hair, and the posterior angles very obtuse, hardly apparent; the posterior margins flatly convex, with six short strong hairs; segment without distinct colored blotches or border; the transverse chitin bar slender, inconspicuous. Metathorax with fine but distinct suture, separating mesothorax; just behind the suture a transverse series of a few very small spines; posterior angles of metathorax with three spines and a hair, two of the spines projecting laterally, the other spine and hair projecting posteriorly; posterior margin straight, with a marginal series of hairs; the posterior angles of the segment are obtuse and project laterally conspicuously beyond the abdomen.

Female. Body, length 1.34 mm., width .5 mm.; head, length .31 mm., width .44 mm.; thus being little larger than the male; the posterior margin of last abdominal segment is uncolored, more convex than in the male, and bears a fringe of short, fine, transparent hairs.

**Menopon longicephalum** n. sp. (Plate lxxiii, fig. 4.)

One male and one female taken from a domestic Pigeon, *Columba livia* (Lawrence, Kansas). Not at all like the uncommon but long known *Menopon* of the Pigeon, *giganteum*, Denny (Anoplur. Brit., p. 225, pl. xxi, fig. 2), or *latum*, Piaget (Les Pediculines, p. 457, pl. xxxvii, fig. 1), but an elongate slender form with head nearly two thirds as long as wide, much like *brevipes*, Piaget (Supplement, 1885, p. 110, pl. xii, fig. 1), from *Crossoptilon mantschuricum*, or *triseriatim*, Piaget (Les Pediculines, p. 460, pl. xxxvii, fig. 3), from *Gallus bankiva.*

Description of male. Body, length 1.5 mm., width .66 mm.; elongate, with narrow tapering head and narrow tapering posterior region of abdomen; whitish, with translucent lateral bands and with inconspicuous head markings.

Head, length .31 mm., width .47 mm.; thus being elongate and narrow for *Menopon;* front parabolic, with one short hair on each side in front of slightly projecting palpi, and one long hair and two short in front of the shallow ocular signature; emargination with ocular fringe running slightly on temporal margin; temples protruding but little laterally, and with one long hair and three short ones; occipital margin weakly concave, with a few hairs of different lengths; small, black, ocular fleck and pale, clear, brownish coloration at side of and behind mandibles.

Prothorax short, broad, with produced lateral angles with a spine in each angle, and a series of fourteen strong, sharply pointed hairs along the convex posterior margin; no blotches. Metathorax short, broad; lateral margin with two or three spines, angles with a hair and nearly straight posterior margin with a series of hairs weaker than those of the prothorax. Legs pale, concolorous with body, with short stiff hairs on femora and tibiæ.

Abdomen elliptical, narrow at both ends, with numerous strong hairs in posterior angles of segments and on lateral margins; numerous hairs on dorsal surface; whole abdomen whitish, with narrow, clear, lateral bands, with lateral processes projecting inward from anterior angles of each segment; last segment uncolored, parabolic, with four hairs on posterior margin, two near each end and none in the middle.

Female. Body, length 1.6 mm., width .69 mm.; head, length .31 mm., width .47 mm.; abdomen elongate-ovate, tapering at posterior end, the last segment uncolored, narrowly rounded behind, with a fringe of fine uncolored hairs along posterior margin.

Description of the male. Body, length 1.8 mm., width .62 mm.; pale, clear, yellowish brown, with small black ocular flecks, slightly darker thorax, indistinctly indicated lateral bands, parallel inner logitudinal bands, and numerous short, stiff, spiny hairs on dorsal surface of abdomen.

Head, length .35 mm., width .55 mm.; not so much wider than long as usual in *Menopon;* forehead or region in front of ocular emargination long; front flatly rounded, with a few short hairs and two longish ones, one longer than the other on a slight swelling in front of the ocular emargination; the ocular fringe distinct, composed of curving, stiff hairs; temples with anterior angles somewhat produced, and four long and two or three short hairs on the margin; small black ocular flecks; weakly colored, translucent, narrow, curving, ocular blotches, and a weakly colored region outside of each mandible; occipital margin medially, narrowly, weakly colored, translucent, with two short median hairs and a shorter one at each side of these two.

Prothorax hexagonal, almost as long as broad, the lateral anterior sides short, the lateral angles obtuse, but little produced, with two spines and a short, stiff hair; posterior margin slightly angulated in the middle, and with six longish hairs, the terminal one being in the posterior angles of the segment; whole segment slightly darker than the head, with short, transverse, uncolored, chitin bar. Metathorax with lateral emargination and faint sutural line between meso- and metasegments; lateral margins bare; posterior angles with two spines and the terminal one of a series of submarginal hairs which are ranged along the straight or very weakly convex posterior margin; anterior angles and lateral margin slightly darker, but otherwise the whole segment concolorous with prothorax.

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irs arranged in complete transverse rows on segments
-3, but decreasing in number on posterior segments;
st segment with posterior margin rounded about as in
male, but with fringe of closely set, short, weak, finely pointed hairs; ventral surface of abdomen with the lateral groups of short spiny hairs as in male.

**Menopon mesoleucum** Nitzch. (Plate lxxiii, fig. 3.)
Germar's Mag. Entomol., 1818, vol. iii, p. 300.

*Ricinus cornicis* De Geer, Mem. Ins., 1778, vol. vii, pl. 4, fig. 11.

*Menopon mesoleucum* N., Burmeister, Handb. f. Ent., 1835, vol. ii, p. 439; Giebel, Zeitschr. f. ges. Naturwiss, 1866, vol. xxvii, p. 119; ibid, Insecta Epizoa, 1874, p. 281, pl. xiv, figs. 11, 12; Piaget, Les Pediculines, 1880, p. 426, pl. xxxiv, p. 7.

A large variety of this species from the American Crow, *Corvus americanus* (specimens from Lawrence, Kansas, and Palo Alto, California). Nitzsch's type-specimens were taken from *Corvus cornix* and *C. corone*. The American specimens are uniformly larger than the type-form (length of *mesoleucum*, male 1.4 mm., female 1.8 mm.; length of var. *americanum*, male 1.7 mm., female 2.12 mm.), and vary from the descriptions of Giebel and Piaget in various particulars.

Var. *americanum* Kellogg. Males, females and young from the American Crow, *Corvus americanus* (Lawrence, Kansas, and Palo Alto, California). Male. Body, length 1.7 mm., width .7 mm.; head, length .34 mm., width .6 mm. Female. Body, length 2.12 mm., width .75 mm.; head, length .37 mm., width .69 mm.

The species may be readily recognized by the marked difference in the sexes, the female having the metathorax produced backward and angulated on the abdomen (straight in the male), and with the transverse abdominal blotches of the first three or four segments broken in the middle and the lateral parts projecting diagonally inward and backward; in the male the blotches run evenly across the segments. I figure the male.

**Nitzschia dubius** n. sp. (Plate lxxiii, fig. 6.)

A few specimens from the Chimney Swift, *Chætura pelasgica* (Lawrence, Kansas). Much like *Nitzschia pulicaris*, Nitzsch, from the European Swift, *Cypselus apus*, but differs in lacking the pustulated hairs of temples and abdomen, and in the shape of the metathorax. The specimens are in poor condition and permit of only an unsatisfactory description.

Body, length 2.22 mm., width .88 mm.; elongate, with narrow neck-like prothorax; expanded posterior portion of abdomen with numerous very long hairs; head, thorax and legs pale, abdomen much darker.

Head, length .41 mm., width .72 mm.; shape of head of *pulicaris*, that is, triangular, with rounded front, a shallow concavity of the margin where the palpi project, a shallow ocular emargination, with conspicuous ocular fringe and expanded temples, the margins angulated in angle with two spines and a hair; posterior angles rounded and the nearly straight, slightly sinuous, posterior margin with six weak hairs; a weakly indicated, uncolored, transverse, chitin bar about even with lateral angles; no distinct blotches. Meso- and metathorax fused, although the line of fusion is marked by a lateral emargination and by an indicated transverse suture; posterior angles of metathorax with two spines and a hair; the straight posterior margin with a submarginal series of short and longer hairs interrupted at the middle; on the dorsal surface of the metasegment six short spines arranged in two diagonal series of three each. Legs long, slender, concolorous with thorax, with fringes of short hairs along dorsal margins of femora and tibiæ. Sternal markings weakly indicated but of the type described as characteristic of *Nitzschia*, consisting essentially of an open quadrilateral without median blotches.

Abdomen widening posteriorly to segment 6; segment 7 a little narrower than segment 6, and segments 8 and 9 narrowing more rapidly; all segments with two to three spines in posterior angles and long hairs, increasing in length and number on posterior segments, those on segments 6–9 being especially long, numerous, and hence conspicuous; segment 9 short, flatly convex behind, with two very long hairs at each end of posterior margin and a sparse fringe of five uncolored hairs along the margin; narrow, translucent, brownish, lateral bands, and the whole abdomen dark, because crossed by broad transverse bands, almost completely covering the surface: posterior margin of each segment with a series of weak hairs.

## DISTRIBUTION.

Concerning the distribution of the Mallophaga, I have little to add to the remarks made in my previous paper. Among the land birds of America there are very few which are identical with the Old World species. On those are found parasites identical, or nearly so, with the Old World Mallophaga of the same hosts. On the domestic pigeon, *Columba livia*, I find *Lipeurus baculus* and *Goniocotes compar*, both common on the European individuals of the same host species. In addition, I find a *Menopon* on the pigeon not met with by the European authors. On the Snow Owl, *Nyctea nyctea*, I find *Docophoros ceblebrachys*, described by Nitzsch from the same host. And there are a few other similar examples.

As among the water birds, where I have found previously described Mallophaga on American birds not identical with Old World species, these parasites have been found, almost always, on American birds very closely related to the European hosts. For example, the characteristic *Docophorus rostratus* Nitzsch, of the European Barn Owl, *Strix flammea*, I have found on the American related to Old World hosts, are presented by *Docophorus communis* and *Nirmus fuscus*. These two parasite species are found, common, in one case, to many passerine birds, and in the other, to several raptorial birds, which differ generically from the Old World hosts. It will be noted, however, that both of these species have a wide range of hosts in both Europe and America. The fact is that we have to do here, in each case, with a group of closely allied, insensibly gradating forms, rather than with a single well marked Mallophagous species. That this condition has been recognized by the European authors is shown in the cases of both *Docophorus communis* and *Nirmus fuscus*, by the attempts which have been made by Giebel and Piaget to break up these species into several distinct species (Giebel), or into subspecies (Piaget).

Finally with regard to the constant or occasional appearance of the parasites on the hosts, I can add also but little. In the preparation of this paper I have had no such long series of specimens of one bird species as it was my privilege to have of certain species of maritime birds. As an illustration of the varying degrees of prevalence of different parasite species infesting a single bird species, the parasites of *Carpodacus mexicanus frontalis*, the House Finch, may be referred to. Of nine specimens of this bird species examined, six were infested by *Docophorus communis*, four by *Nirmus vulgatus*, and one by *Physostomum microcephalum*. Of three specimens examined of the closely related *Carpodacus purpureus californicus*, the California Purple Finch, *Docophorus communis* was found on each, but no *Nirmus* nor *Physostomum* on any. *Physostomum* as a parasite, however, is not always uncommon on its host, as the case of *Physostomum diffusum*, found on five out out of seven specimens of *Melospiza fasciata samuelis*, attests.

Comparing the land birds with the water birds as hosts for Mallophaga, I find that many more individuals among land birds than among water birds are free from parasites, and that among the infested birds the number of individuals of Mallophaga on a single bird individual is much greater among the water bird species than among the land bird species. It is noticeable that the larger land birds such as hawks and grouse show many more parasites than the smaller birds; and to some extent the greater abundance of parasites on water birds may be due to their distinctly larger average size as compared with land birds.

### LIST OF HOSTS AND PARASITES.

- Colinus virginianus.
  - Lipeurus dissimilis.
- Callipepla californica.
  - Lipeurus docophoroides.
  - Goniodes mammillatus.
- Phasianus nycthemerus.
  - Lipeurus introductus.
  - Goniodes cervinicornis.
  - Goniocotes creber.
  - Menopon monostœchum.
- Columba livia.
- Haliæetus leucocephalus.
  - Nirmus discocephalus var. amblys.
  - Colpocephalum flavescens.
- Bubo virginianus.
  - Docophorus cursor.
- Nyctea nyctea.
  - Docophorus ceblebrachys.
- Strix pratincola.
  - Docophorus rostratus.
- Dryobates pubescens.

- Tyrannus tyrannus.
  - Physostomum angulatum.
- Empidonax difficilis.
  - Physostomum sucinaceum.
- Otocoris alpestris.
  - Docophorus communis.
- Corvus corax sinuatus.
  - Docophorus distinctus.
- Corvus americanus.
  - Docophorus atratus.
  - Menopon mesoleucum var. americanum.
  - Colpocephalum subæquale.
- Molothrus ater.
  - Docophorus transpositus.
- Agelaius phœniceus.
  - Docophorus communis.
  - Nirmus illustris.
- Sturnella magna neglecta.
  - Docophorus communis.
- Icterus bullocki.
  - Docophorus communis.
- Carpodacus purpureus californicus.
  - Docophorus communis.
  - Nirmus vulgatus.
- Carpodacus mexicanus frontalis.
  - Docophorus communis.
  - Nirmus vulgatus.
  - Physostomum microcephalum.
- Spinus tristis.
  - Menopon incertum.
- Spinus psaltria.
  - Docophorus communis.
- Spinus pinus.
  - Docophorus communis.
- Calcarius lapponicus.
  - Docophorus communis.
- Ammodramus sandwichensis.
  - Docophorus communis.
  - Physostomum diffusum.
- Zonotrichia coronata.
  - Nirmus vulgatus.
  - Physostomum diffusum.
- Zonotrichia gambeli.
  - Nirmus vulgatus.
- Junco hyemalis.
  - Docophorus communis.
  - Nirmus vulgatus.
  - Physostomum diffusum var. pallidum.
- Melospiza fasciata samuelis.
  - Physostomum diffusum.
  - Colpocephalum chrysophæum.
- Passerella iliaca.
  - Physostomum angulatum.
- Pipilo erythrophthalmus.
  - Menopon melanorum.
- Pipilo fuscus crissalis.
  - Nirmus vulgatus.
- Pipilo maculatus megalonyx.
  - Nirmus vulgatus.
- Cardinalis cardinalis.
  - Docophorus communis.
- Passerina versicolor.
  - Physostomum australe.
- Progne subis.
  - Docophorus domesticus.
  - Menopon dissimile.
- Petrochilidon lunifrons.
  - Docophorus excisus var. major.
  - Nirmus longus.
- Tachycineta bicolor.
  - Docophorus excisus var. major.
  - Nirmus longus.
- Ampelis garrulus.
  - Docophorus communis.
- Ampelis cedrorum.
  - Docophorus incisus.
- Lanius ludovicianus excubitorides.
  - Docophorus communis.
- Harporhynchus rufus.
  - Docophorus communis.
- Psaltriparus minimus.
  - Colpocephalum fumidum.
  - Menopon robustum.

[illegible]
[illegible]
[illegible]
[illegible] communis.
[illegible]
[illegible]

Sialia sialis.
Docophorus incisus.

## EXPLANATION OF PLATES.

[illegible]—Fig. 1, Head of *Colpocephalum flavescens*, under side; *a* antennæ, [illegible] labial palpi, [illegible] maxillary palpi, *d* antennæ (after Nitzsch). Fig. 2, Maxilla of *Trinotum conspurcatum* (after Nitzsch). Fig. 3, Labium of *Trinotum conspurcatum* (after Nitzsch). Fig. 4, Labium of *Tetropthalmus chilensis* (*Menopon titan*); *m* mentum, *p l* labial palpus, *g* glossa, *pg* paraglossa, *hy* hypopharynx (after Grosse). Fig. 5, Labium of a *Nirmus*; [illegible] *pg* paraglossa (after Grosse). Fig. 6, Head, ventral aspect, with [illegible] labium cut away, of *Ancistrona gigas*; *lb* labrum, *md* mandible, [illegible] palpus, *hy* hypopharynx, *f k* labial fork, *a f* antennary [illegible]. Fig. 7, Labium, ventral aspect, of *Ancistrona gigas*; *s m* submentum, [illegible] labial prong, *p* palpifer, *l p* labial palpus, *lig* ligula, *g* glossa, *pg* paraglossa. Fig. 8, Maxilla of *Ancistrona gigas*. Fig. 9, Right mandible, ventral aspect, of *Ancistrona gigas*; *ten* tendon, *mus* muscle, [illegible] chitinous rod, *d c r* dorsal chitinous rod. Fig. 10, Mandibles, ventral aspect, of *Ancistrona gigas*; *c* condyles, *r* right mandible, [illegible] mandible. Fig. 11, Hypopharynx of *Ancistrona gigas*. Fig. 12, Left mandible, ventral aspect, of *Ancistrona gigas*; *mus* muscle.

PLATE [illegible].—Fig. 1, Head, ventral aspect, of *Læmobothrium* sp.; *sm* submentum, *m* mentum, *ant* antenna, *clyp* clypeus, *lb* labrum, *md* mandible, *mx* maxilla, *g* glossa, *pg* paraglossa, *l p* labial palpus. Fig. 2, aspect, of *Eurymetopus taurus; ant h* anterior horn, *b s* "bonnet string." Fig. 4, Right maxilla, ventral aspect, of *Eurymetopus taurus*. Fig. 5, Mandibles, ventral aspect of *Eurymetopus taurus; c* condyles, *r* right mandible, *l* left mandible. Fig. 6, Labium, ventral aspect, of *Eurymetopus taurus; sm* submentum, *m* mentum, *g* glossa, *pg* paraglossa. Fig. 7, "Lingual gland," ventral aspect, of *Eurymetopus taurus; d* duct, *œ s* œsophageal sclerite, *ch ped* chitinous pedicle. Fig. 8, Left "lingual gland," ventral aspect, of *Eurymetopus taurus; d* duct, *ch ped* chitinous pedicle, *mus* muscle, *l g* the gland.

PLATE LXIII.—Fig. 1, Labium of *Colpocephalum* sp.; *sm* submentum, *m* mentum, *pf* palpifer, *lp* labial palpus, *g* glossa, *pg* paraglossa. Fig. 2, Labium of *Trinoton luridum: sm* submentum, *m* mentum, *pf* palpifer, *lp* labial palpus, *g* glossa, *pg* paraglossa. Fig. 3, Labium of *Nirmus* sp.; *sm* submentum, *m* mentum, *g* glossa, *pg* paraglossa. Fig. 4, Mandibles, ventral aspect, of *Menopon titan; c* condyles, *r* right mandible, *l* left mandible. Fig. 5, Labium of *Physostomum angulatum: sm* submentum, *m* mentum, *pf* palpifer, *lp* labial palpus, *g* glossa, *pg* paraglossa. Fig. 6, Labium of *Nitzschia dubius*; *sm* submentum, *m* mentum, *pf* palpifer, *lp* labial palpus, *g* glossa, *pg* paraglossa.

PLATE LXIV.—Fig. 1, Labium of *Termopsis angusticollis; sm* submentum, *m* mentum, *lp* labial palpus, *g* glossa, *pg* paraglossa. Fig. 2, Maxilla of *Termopsis angusticollis; cd* cardo, *st* stipes, *pf* palpifer, *lac* lacinia, *gal* galea, *mx p* maxillary palpus. Fig 3, Labium of nymph of *Perla; sm* submentum, *m* mentum, *l p* labial palpus, *g* glossa, *pg* paraglossa. Fig. 4, Maxilla of nymph of *Perla; cd* cardo, *st* stipes, *lac* lacinia, *gal* galea, *mx p* maxillary palpus. Fig. 5, Head, ventral aspect, of *Atropos* sp.; *sm* submentum, *m* mentum, *mx* maxilla, *mx p* maxillary palpus, *md* mandible, *clyp* clypeus, *lb* labrum, *g* glossa, *pg* paraglossa, *fk* fork. Fig. 6, Mandibles of *Atropos* sp.; *c* condyles, *r* right mandible, *l* left mandible. Fig. 7, Head, dorsal aspect, of *Atropos* sp.; *clyp* clypeus, *ant* antenna, *œ s* œsophageal sclerite. Fig. 8, Mandible and mandibular muscles of *Psocus* sp.; *f m* flexor muscle, *e m* extensor muscle, *m* molar face of mandible (after Burgess). Fig. 9, Longitudinal section through middle of head of *Psocus* sp.; "*cl* clypeus, *l* labrum, *mand* mandible, the dotted line ending on the ribbed molar surface which tapers beneath into the sharp cutting edge; *mx* maxilla, *t* tongue, *f* fork, *lb* labium and *l p* its palpus, *m* mentum, *l g* lingual gland and *g m* its suspensory muscle, *œ* œsophagus opening below into the oral cavity at the base of which is the œsophageal bone, *œ b*; *f m* flexor muscle of the mandible and *l m* the muscle of the labrum, *c m* muscles of the clypeus, *g l* supra-œsophageal ganglion" (after Burgess). Fig. 10, Labium, posterior aspect, of *Psocus* sp.; "*m* mentum, *lb* labium, *l p* one-jointed labial palpus, behind which one sees the tip of the fork, *f*; *c* cardo, *p* stipes having the four-jointed [illegible] through the mentum can be seen the lingual [illegible] after Burgess). Fig. 11. (Esophageal [illegible] frontal aspect, of *Psocus* sp.: *l d* duct [illegible] after Burgess).

[illegible]—Fig. 1. *Docophorus [illegible]cephalus* Kellogg, ♂. Fig. 2. [illegible] Kellogg. Fig. 3. *D. [illegible]* Kellogg, ♂. Fig. 4. *D. domes[illegible]* Kellogg. Fig. 5. *D. [illegible]* Kellogg, ♂. Fig. 6. *D. transpo[illegible]* Kellogg.

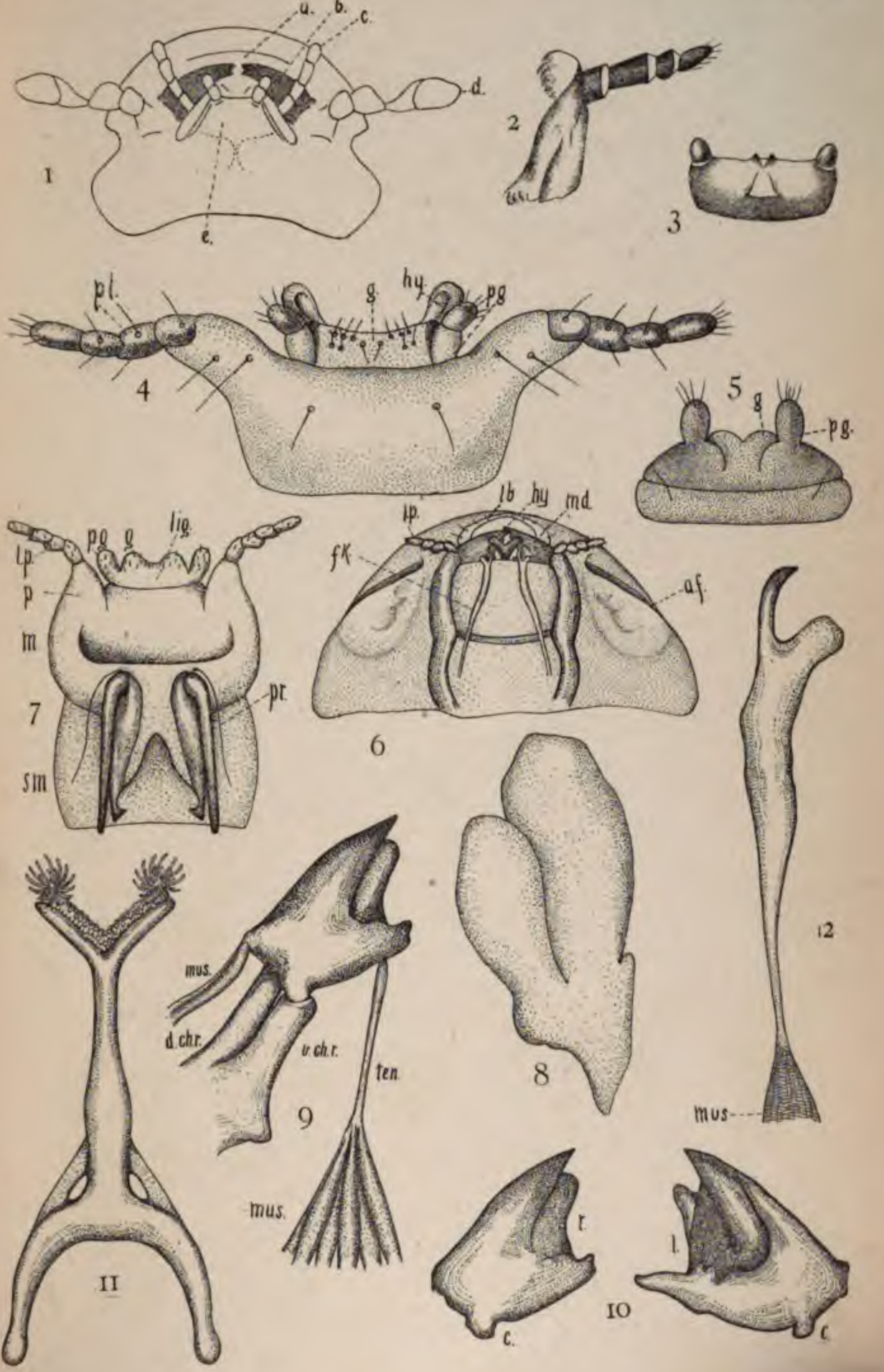
[illegible]—Fig. 1. *Docophorus cursor* N., ♀. Fig. 2. *D. evagans* Kellogg. Fig. 3. *D. [illegible]* N., ♂. Fig. 4. *D. jungens* Kellogg. Fig. 5. *D. [illegible]* N., ♀. Fig. 6. *D. californiensis* Kellogg, ♂. Fig. 7. [illegible] N., ♀.

[illegible]II.—Fig. 1. *Nirmus longus* Kellogg, ♀. Fig. 2. *N. simplex* Kellogg. Fig. 3. *N. [illegible]* Kellogg, ♀. Fig. 4, *N. illustris* Kellogg. Fig. 5. *N. [illegible]* Kellogg, ♀. Fig. 6. *N. discocephalus* var. *amblys* Kellogg. Fig. 7. *N. [illegible]* N., ♀.

PLATE [illegible]VIII.—Fig. 1. *Lipeurus introductus* Kellogg, ♀. Fig. 2, *L. [illegible]* Kellogg, ♀. Fig. 3. *L. macrocephalus* Kellogg, ♀. Fig. 4, *L. [illegible]* head of ♀. Fig. 5. *L. introductus* Kellogg, head of ♂. Fig. 6. *L. [illegible]* N., ♀. Fig. 7. *L. assimilis* P., head of ♀. Fig. 8, *L. [illegible]* P., ♀.

PLATE [illegible]XIX.—Fig. 1. *Goniodes cervinicornis* G., ♀. Fig. 2, *Goniodes [illegible]* [illegible], ♀. Fig. 3. *Goniocotes creber* Kellogg, ♀. Fig. 4, [illegible] N., ♀.

PLATE [illegible]XX.—Fig. 1. *Physostomum microcephalum* Kellogg, ♀. Fig. 2. *P. [illegible]* Kellogg, ♀. Fig. 3. *P. diffusum* Kellogg, ♀. Fig. 4, *P. [illegible]* Kellogg, ♀. Fig. 5. *P. angulatum* Kellogg, ♀.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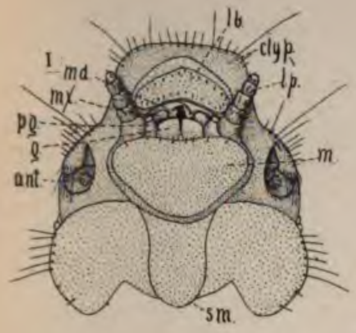
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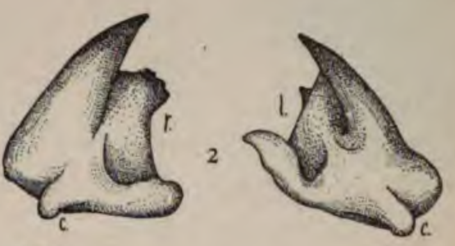
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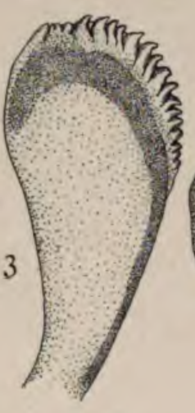
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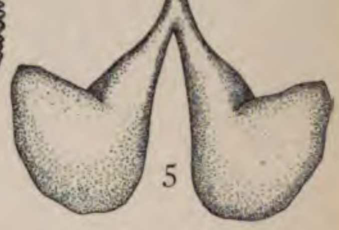
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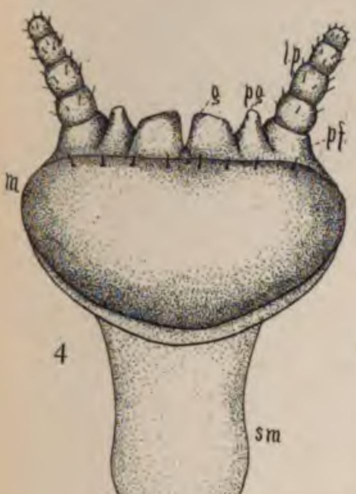
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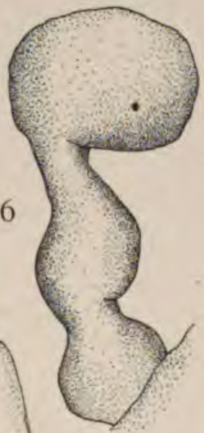
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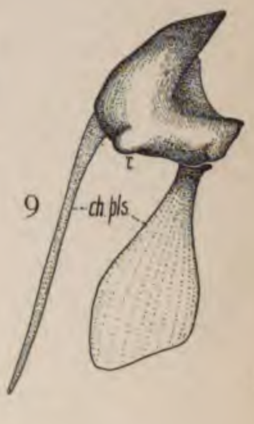
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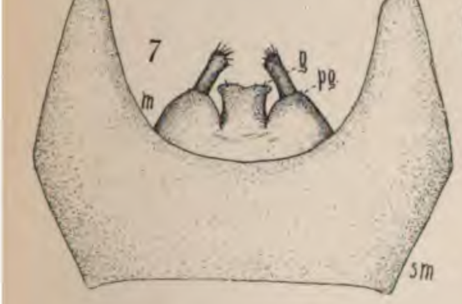
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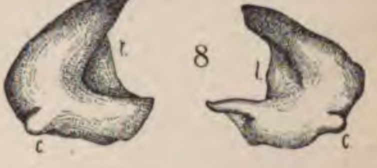
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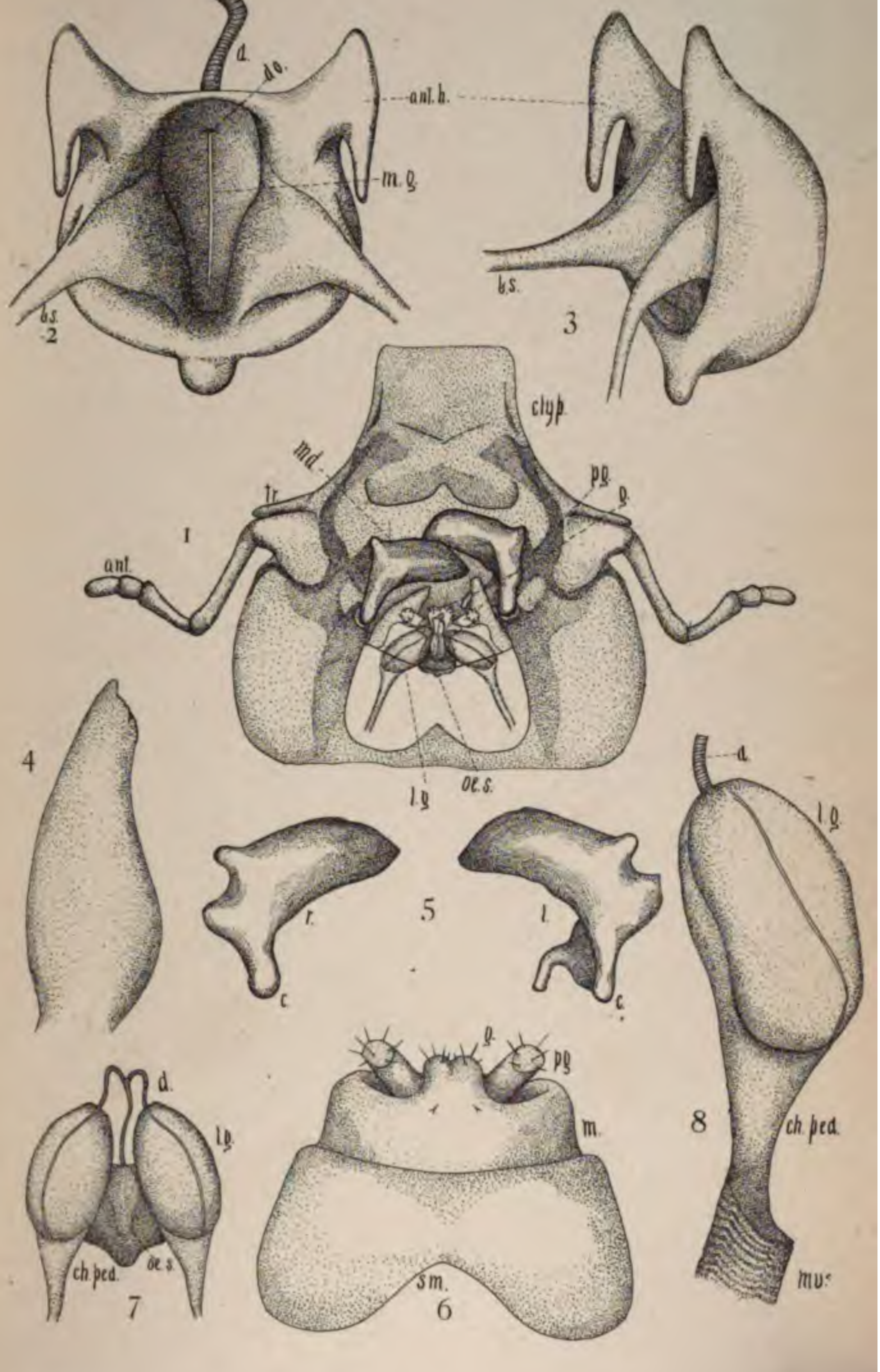

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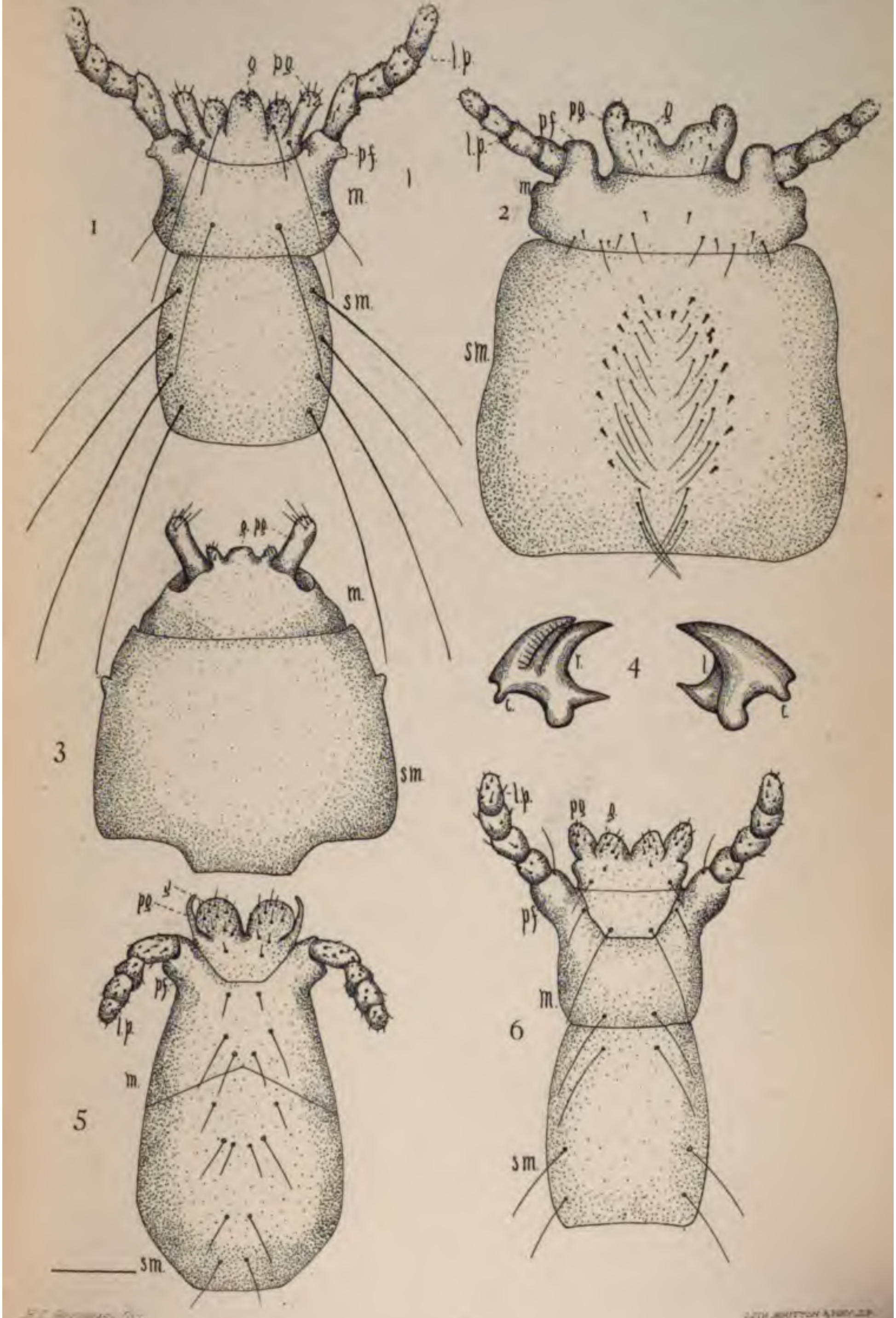

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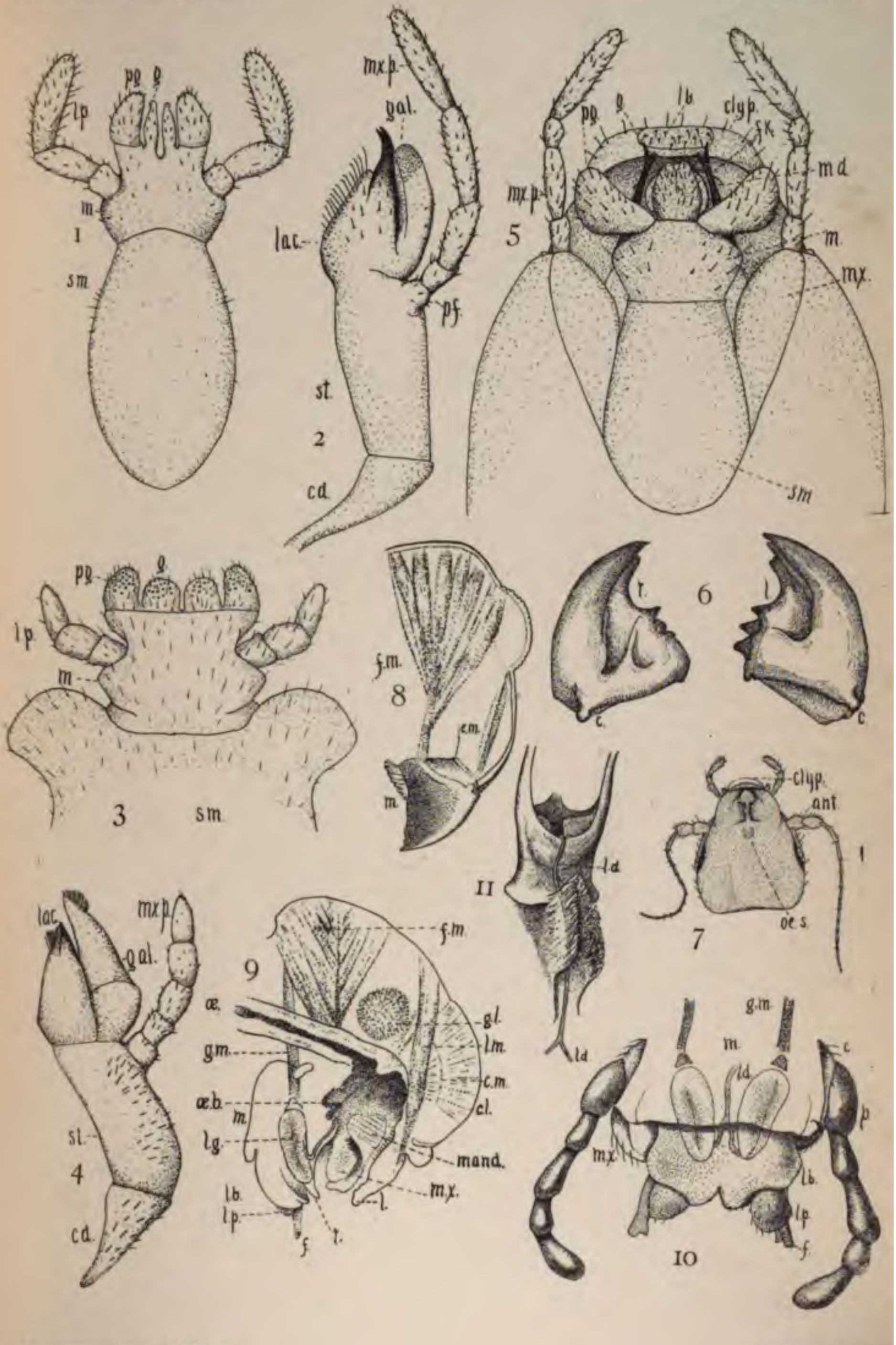
LITH. BRITTON & REY, S.F.



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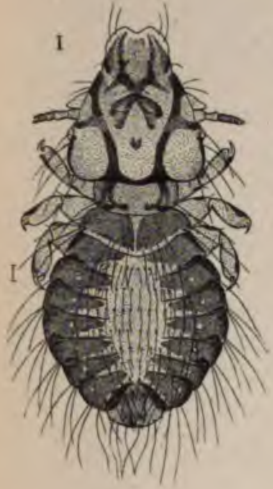

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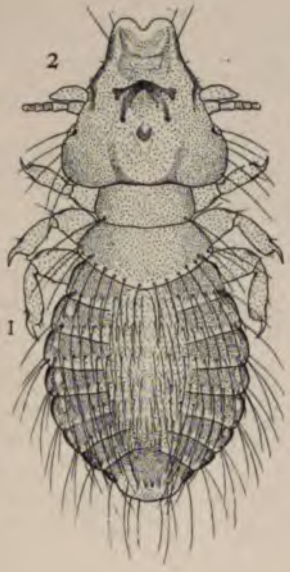

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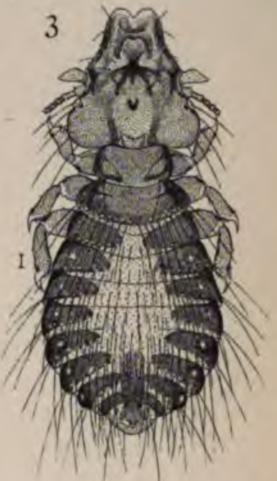

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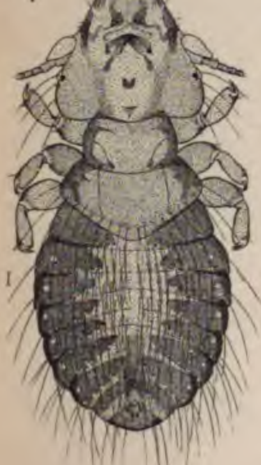

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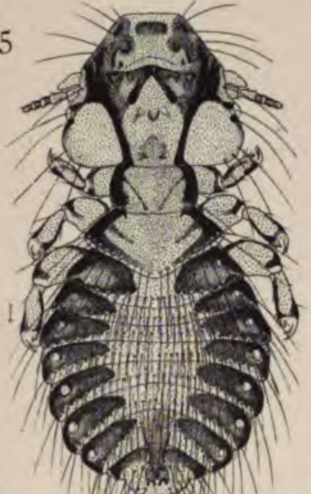

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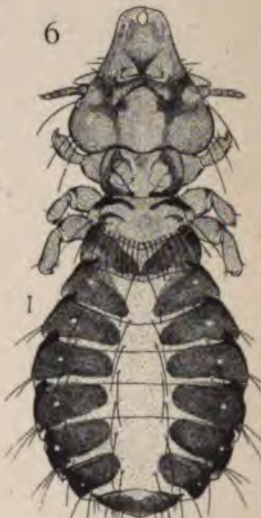

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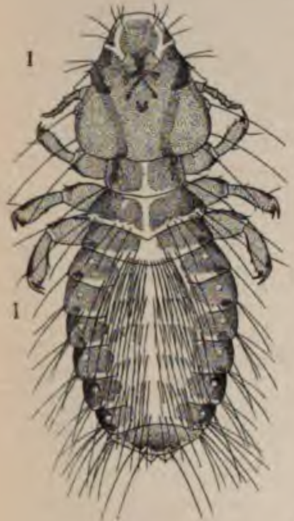

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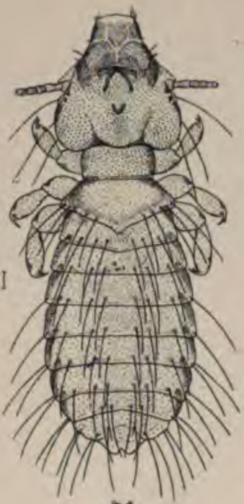

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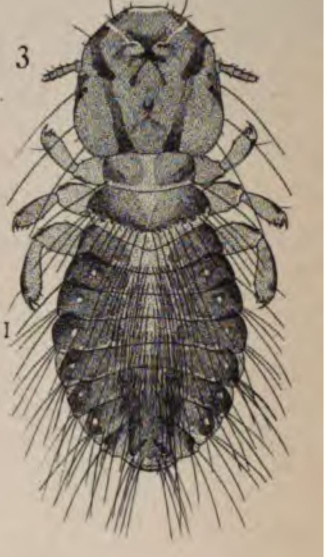

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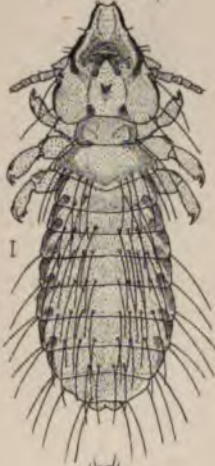

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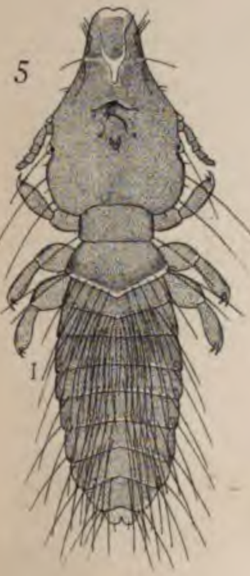

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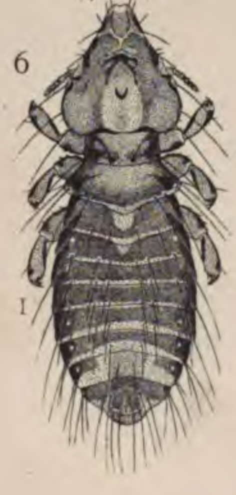

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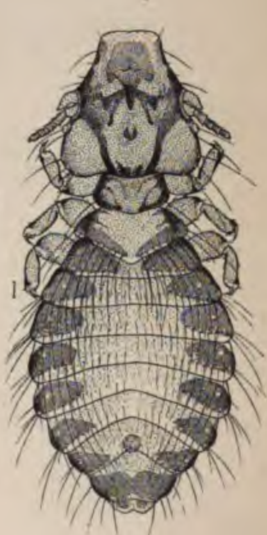

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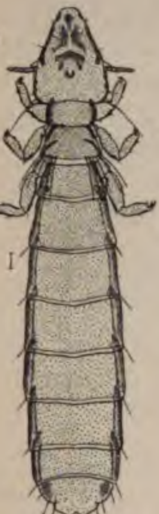

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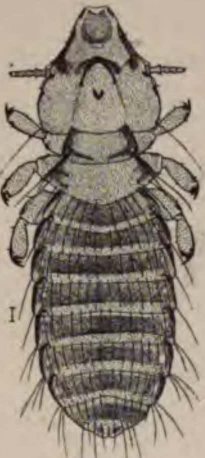

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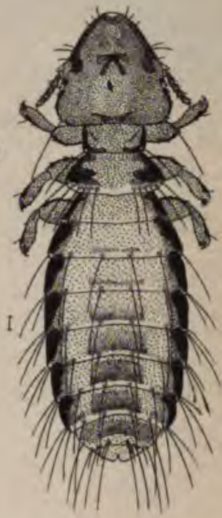

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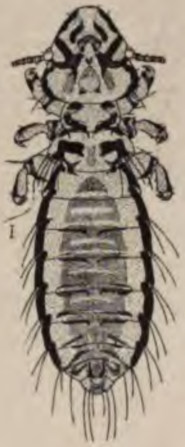

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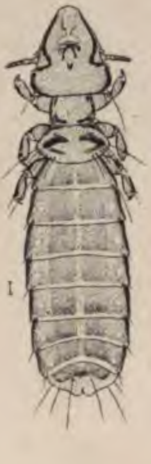

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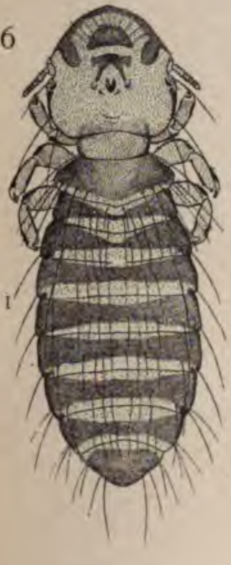

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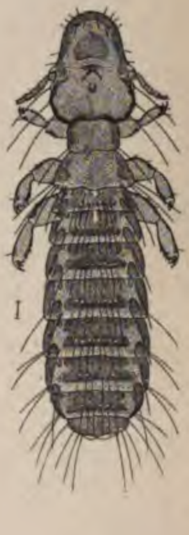

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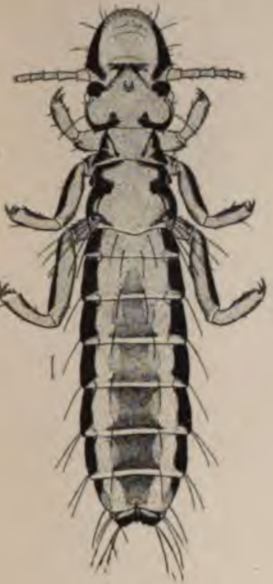

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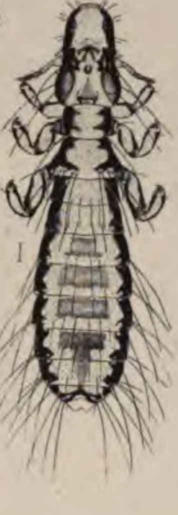

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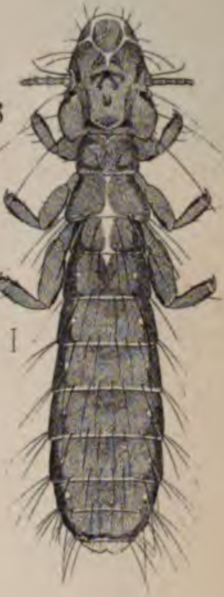

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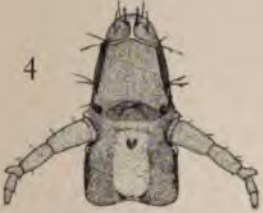

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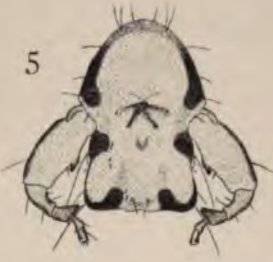

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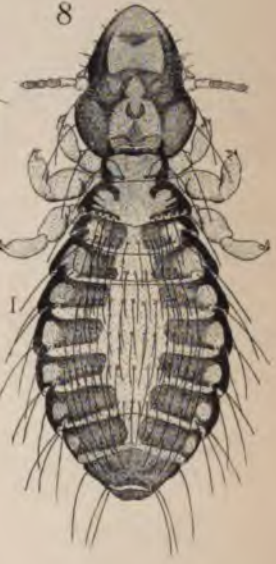

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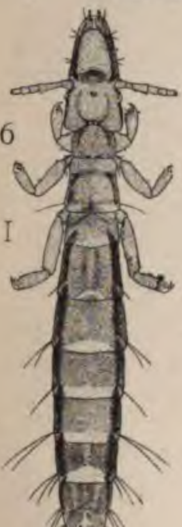

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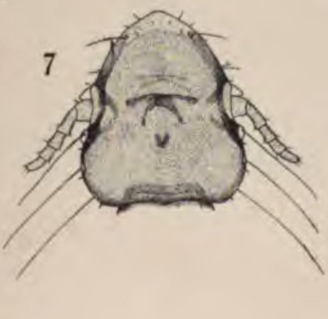

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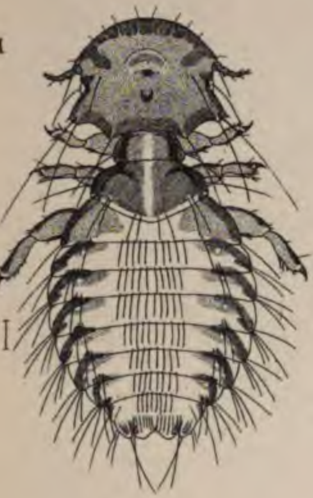

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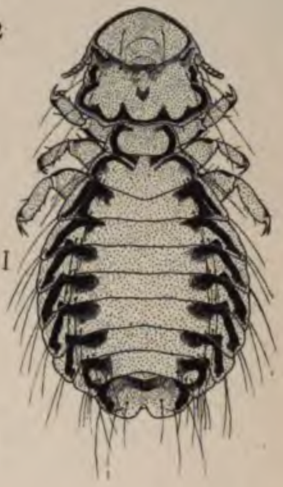

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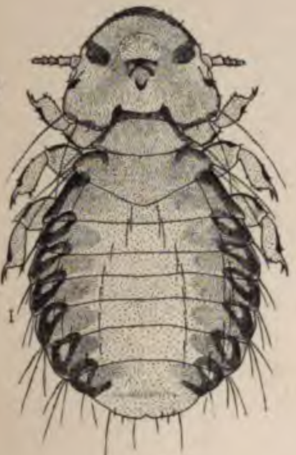

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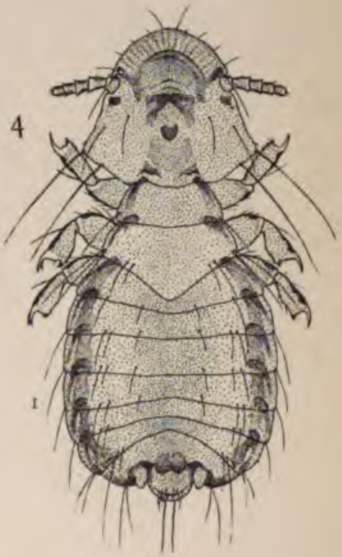

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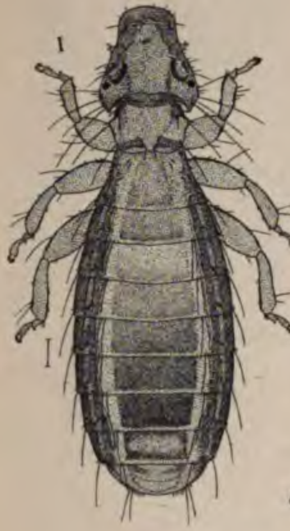

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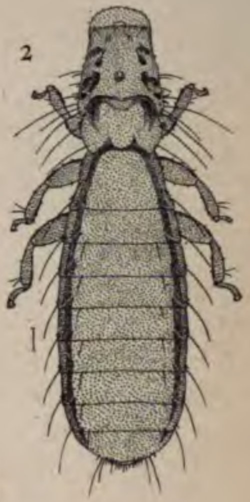

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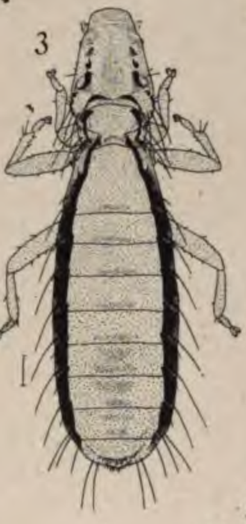

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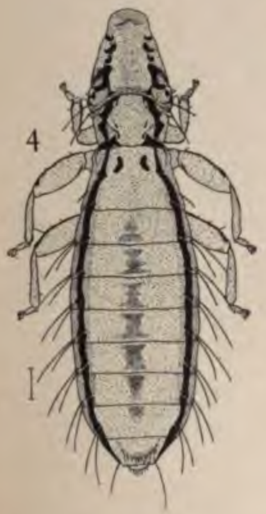

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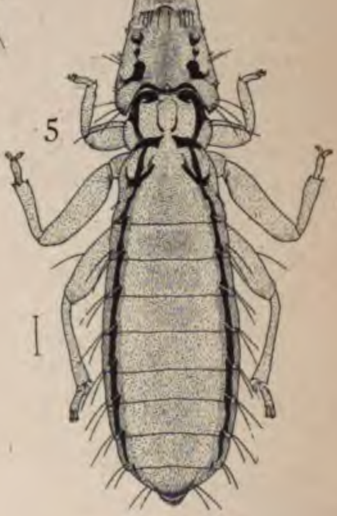

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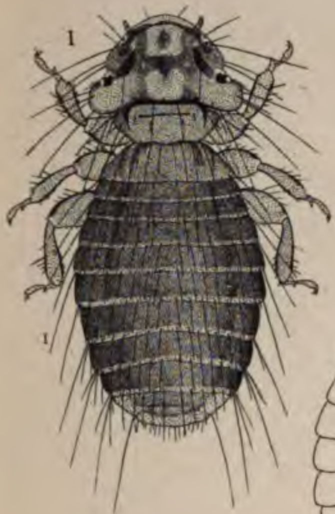

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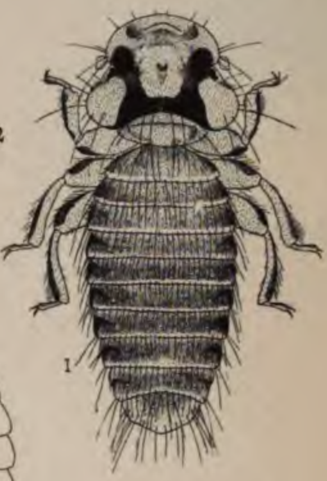

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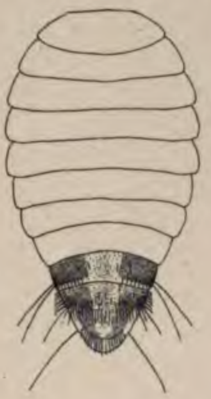

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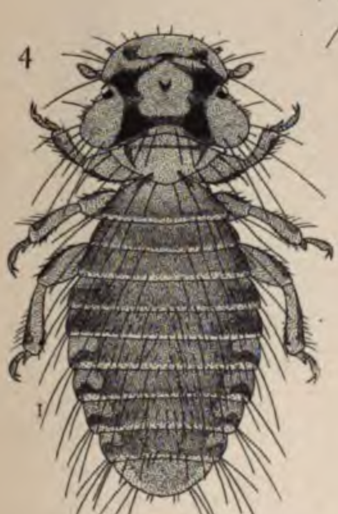

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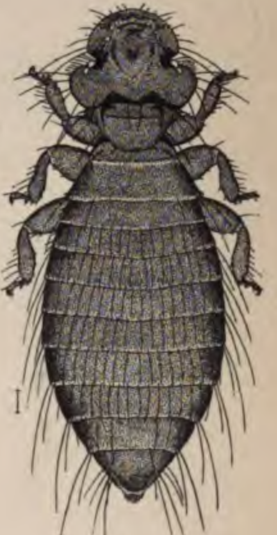

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PLATE LXXII.

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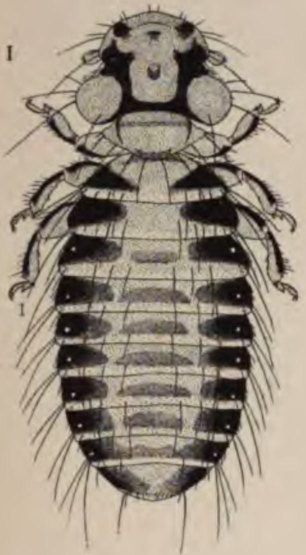

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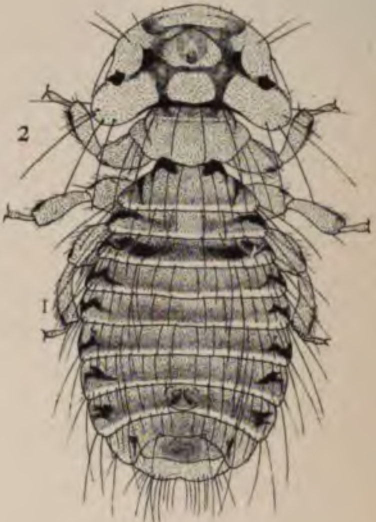

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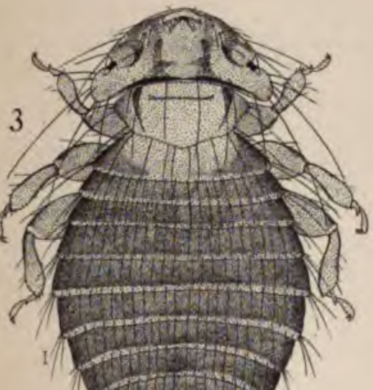

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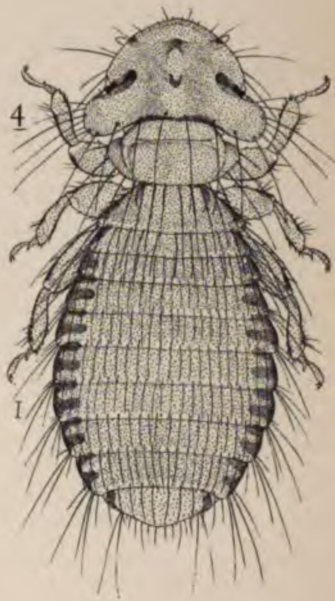

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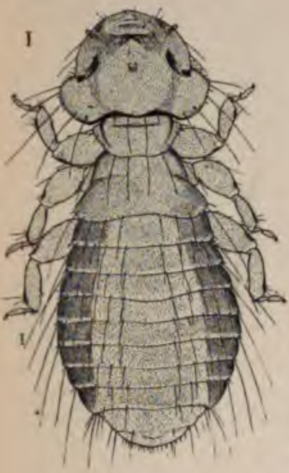

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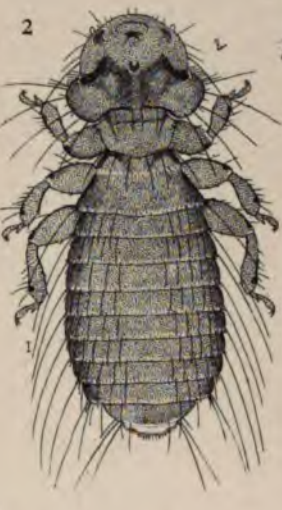

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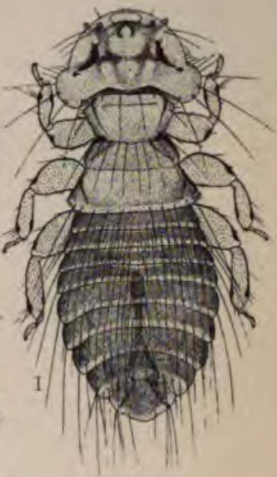

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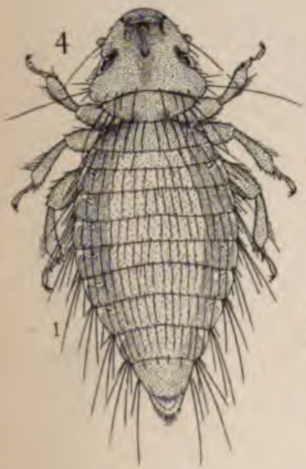

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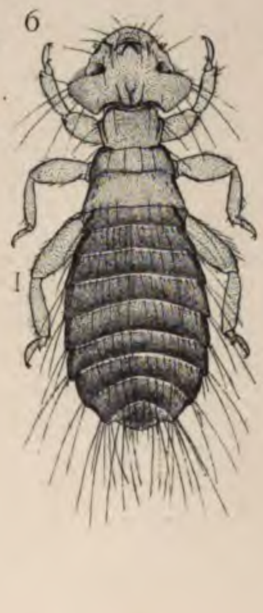

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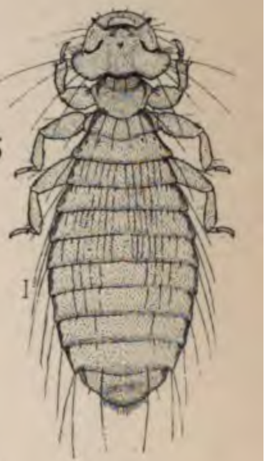

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# PROCEEDINGS

OF THE

# ROYAL PHYSICAL SOCIETY

OF

# EDINBURGH.

1859–1862.

VOL. II.

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# PROCEEDINGS

OF THE

# ROYAL PHYSICAL SOCIETY.

---

## EIGHTY-EIGHTH SESSION, 1858–59.

*Wednesday, November* 24, 1858. Professor BALFOUR in the Chair.

The following Gentlemen were elected Members of the Society:—

William Carruthers, Esq.; William Turner, M.B., Demonstrator of Anatomy, University of Edinburgh. Foreign Member—Count Victor Motschoulsky, St Petersburgh.

The Donations to the Library included the following, and thanks were voted to the donors:—

1. Proceedings of the Royal Society of Edinburgh, Session 1857–58. From the Society.—2. Canadian Journal, Toronto, Nos. XV., XVI., and XVII. From the Canadian Institute, Toronto.—3. Papers read to the Botanical Society of Edinburgh. By George Lawson, Ph.D. From the Author.—4. The Practical Naturalist's Guide. By James Boyd Davies. From the Author.

Professor BALFOUR then delivered the Opening Address as follows:—

It has been the usual practice in the Society that the retiring President shall give a short address on the occasion of his demitting office, and, in conformity with that custom, I have been called upon by your Secretary to make a few remarks this evening when I conclude my period of probation as President. The task is by no means an easy one, from the difficulty of finding some new topic of interest on which to expatiate. The history of the Society has been already given by my predecessors, and the obituaries of the eminent members who have lately been taken from us (a topic which in most Societies occupies much of the opening addresses), have already been given by Fellows of the Society, more competent for the duty than myself. It has occurred to me that a brief notice of two Edinburgh Natural History Societies, which have now ceased to exist, and more particularly of the Wernerian Society, might not be altogether uninteresting.

Natural History studies are peculiarly fitted to call forth the principles of association. There is something connected with the prosecution of them which draws students together, and which binds them by ties of no ordinary kind. The study of the Rocks and Minerals, Plants and Animals, of our globe naturally leads to extended wanderings over mountain and plain, by river side or ocean shore, during which the companionship of friends becomes especially valuable and cheering. There is a sociality in such pursuits which insensibly unites men in scientific brotherhood. Those who have joined in natural history excursions know well the fascination of such rambles, and look back with pleasure to the friendships thus formed. The collections made become also bonds of union. For every naturalist knows the importance of the interchange of specimens. The system of exchange has led to the formation of many associations. It was this which in a great measure led to the institution of the Botanical Society of this city.

Edinburgh has been long celebrated for its Natural History Societies. The situation of our city, the rich fauna and flora of its neighbourhood, its instructive geological and mineralogical features, have rendered it one of the places best fitted for but it still exists, and has now entered on its eighty-eighth session; and though its resources are not so large as they once were, the zeal of its members I trust is not abated. We have among us many active naturalists whose labours have advanced natural history, and whose original researches have increased the fame and reputation of our school.

Besides the Royal Physical Society, there were other Natural History Societies in Edinburgh, especially among the students of the University. One of them was the Plinian Society, which, during its short existence, tended much to foster the spirit of inquiry, and to call forth the efforts of the junior naturalists of Edinburgh. It was essentially a students' society, and met within the walls of the College. It began its existence on 14th January 1823, and continued to meet till about the year 1835. It enrolled among its members many young naturalists who afterwards acquired eminence, such as Wm. Baird, now in the British Museum; M'Vicar, now minister of Moffat; Jameson Torrie, well-known for his Natural History labours in connection with his uncle Professor Jameson; Ainsworth, who published Travels in the District of the Euphrates; Cheeke, the editor of a valuable Natural History Journal; Malcolmson, celebrated for his geological pursuits in India; Anderson of Inverness, whose guide to the Geology and Natural History of the Highlands is so justly praised; Robert Grant, now Professor of Comparative Anatomy in London; John Coldstream, one of the Fellows of our Society, whose labours in Zoology are deservedly famous; Clouston, now a clergyman at Sandwick, who has done much to elucidate the flora of Orkney; Woodforde, who published the Flora of Edinburgh; Lombard of Geneva; John Addington Symonds, now a distinguished physician at Bristol; Hugh Falconer, the Indian Botanist and Zoologist; Browne, one of the Commissioners of Lunacy, and many others. If I were to analyse the proceedings of that Society, I could show that many of those gentlemen exhibited in their communications the early dawnings of their devotion to those departments of science in which they afterwards attained distinction. I feel that not a little of the zeal with which I prosecuted botany was due to my early connection with this Society.

Unfortunately, like some other societies, it had its decay and decline, and, after a brief existence of about twelve years, it ceased to exist. On 6th Febuary 1841, the society was dissolved, and its books and herbarium were divided between the Royal Medical and the Hunterian Medical Societies.

In its flourishing days this Society was supported mainly by students, and it is probable that its decline may be attributed in some measure to the want of some zealous senior members resident in Edinburgh, who, by associating with students in practical natural history, would have kept up the vigour of the Society.

We now come to another Natural History Society, the nature of which differed essentially from that of the Plinian and other student-societies, and whose period of existence extended over more than forty years, but which has also come to a termination—I mean the Wernerian Natural History Society. This Society owed its origin to Professor Jameson, whose enthusiastic devotion to natural history, and whose eminence in mineralogy rendered his name famous all over the world. TheSociety thus instituted by him was restricted to senior naturalists. While it lasted, it rendered good service to science, and by the publication of its valuable Memoirs acquired a wide-spread reputation.

The Wernerian Society commenced in 1808, and the following is the record of its foundation :—

in honour of the illustrious Werner of Freyberg, to assume the name of the Wernerian Natural History Society.

Professor Jameson having been called to the chair, the following office-bearers were unanimously elected:—

Professor Jameson, *President.*
Dr Wright,
Rev. Dr Macknight, *Vice-Presidents.*
Dr Barclay, and
Dr Thomson,
Mr Walker, *Treasurer.*
Mr Neill, *Secretary.*

It being understood that the Society should consist of honorary, foreign, non-resident, and ordinary members, it was moved by the president, and unanimously agreed to, that

Professor Werner of Freyberg,
Sir Joseph Banks, Bart., President of the Royal Society, and
Richard Kirwan, Esq., President of the Royal Irish Academy,

be enrolled as the first honorary members of the Society.

The following gentlemen were then chosen non-resident members:—

Dr James Edward Smith of Norwich, President Linnean Society.
Rev. Dr John Stuart of Luss.
Dawson Turner, F.R.S., Yarmouth.
Robert Brown, F.R.S., F.L.S.
The Hon. Mr Greville, F.R.S.
Charles Hatchett, F.R.S.
Count de Bournon, F.R.S.
George Shaw, M.D.. F.R.S.
Wm. Henry, M.D., Manchester.

And the following were elected foreign members:—

M. Frederick Möhs, Styria.
Professor Karsten, Berlin.
Professor Klaproth, Berlin.
M. Von Buch, Berlin.

M. Von Humboldt, Berlin.
M. Freiesleben, Thuringia.
M. H. Meuder, Freyberg.
M. Herder, Freyberg.

Such then was the institution of the Wernerian Society.

On the 20th January 1808, the laws of the Society were drawn up by a committee.

In regard to resident members it is ruled that the number shall not exceed 100; and in regard to honorary members that they shall not exceed 10.

The meetings were held in the College Museum, or in a room adjoining to it, at two o'clock in the afternoon.

All natural history specimens presented to this Society were to be deposited in the College Museum.

A charter or seal of cause was subsequently obtained from the Town-Council, and the Society was incorporated on 10th February 1808, under the name of the Wernerian Natural History Society.

The first meeting for public business took place on 2d March 1808, in the College Museum.

The record of the proceedings of the Society from that time up to April 21, 1838, is printed as an appendix to the published Memoirs of the Society, vols. ii.–vii.

In these volumes valuable papers are given on various departments of Natural History.

Dr Traill, Dr Dewar, Mr Swainson, Mr Edmonston, Dr Knox, Mr Selby, Dr Hibbert, Dr Richardson, Mr Coldstream, Rev. David Scot, Mr William Jardine, Mr Parnell, Dr Grant, Mr Macgillivray, Dr Craigie, Mr J. Duncan, and Mr Edward Forbes. In Meteorology—Rev. Dr Scoresby. In Physical Science—Mr Stevenson, Dr Brewster, Mr Adie, and Mr Deuchar.

The Society continued to hold meetings with more or less regularity up to 1850; and I have drawn up from its records the following notices, in continuation of its published proceedings:—

On the 11th August 1838, the Society proposed to encourage the study of Natural History, by the offer of premiums for the best essays on certain subjects in Hydrography, Geology, Zoology, and Botany. These were subsequently advertised.

The thirty-second session of the Society was opened on 24th November 1838, by Professor Jameson; and on the 15th December of that year, papers were read by Dr Traill on the *Cheirotherium;* and by Sir John Dalyell on a singular mode of propagation in some of the lower animals; besides communications on the Geology of Melrose and Earlston, and on Meteorology.

On 12th January 1839, Professor Jameson exhibited *Labrus trimaculatus* and *Gadus minutus*, two rare fishes which had been found in the Pentland Firth; and the carcass of a large cinereous eagle, "being one of the two birds of that kind which had the boldness to attack a traveller near Newton-Stewart in Galloway."

On 26th January 1839, Mr Smith of Jordanhill read observations on the elevated marine deposits in the basin of the Clyde, accompanied with remarks by Deshayes, Lyell, and Sowerby, on the shells unknown as British imbedded in them, from which it appeared that, out of twenty species, seven are at present to be found recent in the Arctic Seas, five in the Crag and Sicilian Newer Pliocene, and that the rest are peculiar to the deposit in question. Edward Forbes was proposed as a member by Professor Jameson, and his nomination was seconded by Dr Neill. He was admitted on 9th February. At the same meeting, Professor Wallace explained by a model his solution of the Miner's Problem, in reference to the security of the foundation of the houses in Moray Place.

On the 23d February, Mr E. Forbes read a communication on the *Asteriadæ* of the Irish Sea, which was afterwards published in the Society's Memoirs. This was one of Forbes's early papers, and gave indications of what might be expected from his natural history labours.

On 9th March 1839, Mr Cunningham read a valuable paper on the Geology of the islands of Eigg, Rum, and Canna, which was subsequently published in the Society's Memoirs.

The session was closed on 20th April 1839; and the twenty-third session was opened on 23d November, when, among other notices, I find that Edward Forbes was made a member of Council.

On 7th December 1839, Mr R. J. Hay Cunningham read an essay on the relations of granite and trap to stratified rocks, illustrating it by twenty-six large coloured sections, showing numerous contortions, in which there is no evidence of the granite having been forcibly injected so as to produce shifting. Mr Macgillivray exhibited a specimen of the butcher bird (*Lanius excubitor*), shot at Whittinghame by Mr Archibald Hepburn.

On 21st December 1839, a communication was read from Professor Ehrenberg on the calcareous and siliceous microscopic animals which form the chief component parts of chalk ment to a Society lately formed in Edinburgh for the prevention of cruelty to the inferior animals."

On 25th January 1840, Forbes read an account of the *Entozoa* of the *Cydippe pileus*, showing that, besides a *Filaria*, there is a curious tongue-shaped parasitic animal, which was first detected by Major Playfair of St Andrews, and has been called by Forbes *Tetrastoma Playfairii.*

On 22d February 1840, Lord Greenock's discovery of *Sulphuret of Cadmium* in rocks on the banks of the Clyde is noticed, and the mineral is called Greenockite by Professor Jameson. Mr Cunningham read a paper on the Geognosy of the Island of Arran.

On 7th March 1840, Mr Bald read a notice regarding the extent and commercial value of the blackband ironstone in Scotland; and Mr James Wilson recorded the result of Mr Shaw's observations on the fry of the salmon.

On 4th April 1840, Professor Jameson proposed that the Society strongly recommend the measuring of the heights of the coast lines of Fuci along the shores of Scotland, the Hebrides, and the Orkney and Shetland Islands; and the Society accordingly remitted the subject particularly to Dr Greville, Mr Robert Stevenson, and Mr Edward Forbes; and further directed the Secretary to intimate the recommendation to the Rev. Charles Clouston of Sandwick, Dr George Johnston of Berwick, and Dr Edmonston of Unst. Professor Jameson showed specimens of compact felspar of great hardness, from a bed which has occurred in the deep cutting for the Edinburgh and Glasgow Railway, very near Winchburgh, and has greatly impeded the operations.

On 18th April 1840, Edward Forbes made observations on certain rare British zoophytes, illustrated by drawings.

On 14th November 1840, Mr John Goodsir is recommended as a member by Professor Jameson and Dr Neill; and he was elected on 29th November. At that meeting, Forbes read a communication on the classification of *Mollusca.*

On 12th December 1840, Dr Richardson sent a communication on the frozen soil of North America. Mr Goodsir read an account of certain peculiarities in the structure of the short sun-fish (*Orthagoriscus mola*), as observed in a large specimen lately captured in the Firth of Forth, near Alloa; and on 9th January 1841, he gave an account of the anatomical structure of *Ascidiæ*, showing that even the rough covering of these animals is highly vascular; and at the same meeting, Mr Jameson Torrie noticed traces of former glaciers in the south of Scotland, and mentioned the occurrence of fossil trees near Galashiels.

On 23d January 1841, Edward Forbes made a communication on the Natural History of *Echiurus* and *Thalassema*, two genera of Echinodermata; and Mr John Goodsir explained the structure of these animals. Forbes also noticed a new genus of British Helianthoid Zoophyte, called by him *Capnea*.

On 6th March 1841, Dr Fleming gave an account of a new British species of *Raia*.

On 17th April 1841, Mr Goodsir read a communication from his brother, Mr Henry Goodsir, containing an account of a new genus, with description of new species, of *Pycnogonidæ;* also, an account of *Pelonaia*, a new genus of tunicated mollusca.

On 11th December 1841, an account of St Kilda and its Natural History was read, as transmitted by Mr John Macgillivray.

On 28th April 1842, Professor Jameson exhibited the following fishes which had been taken in the Firth of Forth, chiefly in Aberlady Bay:—1. Tunny, 8 feet long, and 5 feet 6 inches in circumference where thickest. 2. Portbeagle Shark, 7 feet from his brother, Henry Goodsir, of the *Maidre*,—a vast accumulation of minute marine animals, which precede the appearance of a herring shoal off the Isle of May. He described also a new species of *Cetochilus*.

Mr Goodsir continued for many seasons to give interesting anatomical communications from himself and his brother.

In February 1845, Dr Traill read a paper on the arrangement and character of serpents, while John Goodsir gave a description of *Neuronoia Monroii*, a species of Entozoon, infesting the nervous system of the *Gadidæ*.

On 7th March 1846, Mr Goodsir communicated original observations on the organs of circulation of the Echinodermata.

28th March 1846, Dr Fleming read a paper on raised beds of shells occurring on the coasts of Scotland; and Mr John Goodsir read a paper on the anatomical structure of the *Hyperoodon Dalei*, taken from a specimen stranded near Alloa. And on 19th December 1846, Professor Goodsir exhibited the living larva of *Medusa aurita*.

On 20th February 1847, Professor Goodsir read a paper on the morphological constitution of the skeleton of sponges.

3d April 1847, Dr Martin Barry read a paper on the nucleus of the animal and vegetable cell. On 27th November 1847, the completion of the bust of Professor Jameson is recorded, and a statement is made as to its being placed in the Museum. There was no meeting from 27th November 1847 till 22d April 1849, owing to Professor Jameson's illness.

Meetings became very irregular. In 1849, the forty-third session commenced on 24th November, and that was the only meeting for the session.

The forty-fourth session commenced on 23d November 1850, Professor Jameson in the chair. The president stated on the occasion that Dr Neill, the secretary, was prevented from attending by illness, a circumstance which he believed had not occurred previously in the history of the Society since its foundation in 1808. At this meeting Messrs Torrie, Greville, and Hamilton, were requested to act *pro tempore* as secretaries.

The Society then adjourned, and did not again meet for business.

The minute is signed by Robert Jameson, President.

In March 1856, a meeting of the members of the Society was summoned to consider its state and prospects.

The circular calling the meeting was subscribed by Messrs Adie, Fleming, Traill, Jardine, and Balfour, V.P.; Greville, Trevelyan, Goodsir, Deuchar, Councillors; Ellis, Treasurer; Torrie, Secretary; Wilson and Hamilton, Librarians.

Various meetings took place on the subject. Proposals were made to revive the Society, and many members promised active support. But after full consideration it was finally resolved, in November 1857, to wind up the Society's affairs, and transfer the funds and property in certain proportions to the Royal Physical and the Botanical Societies.

Here, then, we have another instance of the failure of a Society which had during a long period a career of no small celebrity and usefulness. To what are we to attribute this? Chiefly, I think, to the fact of its absolute dependence on one man, Professor Jameson. Nothing was done without his sanction. He was perpetual president, and no meetings were called except by him. Along with the worthy secretary, Dr Neill, he managed all the business; and when, during the latter years of life, the Professor was incapacitated from taking an active part in the proceedings, no meetings took place, and the Society languished; and on his death all attempts to resuscitate it were found to be hopeless.

The connection of the Society with the Museum led, in a society (Wernerian) fail from decline of activity among senior naturalists, and the want of the infusion of young blood to carry on the scientific circulation.

Our own Society, the Physical, has had its times of prosperity and adversity, but it has survived all shocks, and its success seems to be owing, in a great measure, to the well-assorted co-operation of senior and junior members. The zeal and enthusiasm of the young naturalist has imparted animation to all; while rash theorising or hasty generalizations have been curbed by the prudent councils of such veterans as Fleming. There is a wholesome balance, which enables the Society to exhibit its vitality in well directed efforts for the advancement of true science.

The Society does not confine itself to the mere reading of papers and communications, but encourages active practical operations among its members. Its Committees for dredging, and for the prosecution of geology and of entomology, are well-fitted to bring out the zeal of its Fellows, and to initiate the junior votaries of science in the details of field work. Such a system is calculated to secure the permanence of the Society, and to produce valuable results. Mere reading will never make a man a naturalist. He must touch and handle the *ipsissima corpora*, and must observe the phenomena as presented to his senses by nature itself. Researches conducted under the auspices of those who have already in some measure mastered a science are of the highest value to the tyro.

If we wish the Society to go on prosperously, we should encourage young men to enter while they are studying here. We may thus hope to raise up naturalists who will do good service in after life, and who, when they visit different quarters of the globe in future years, may be expected to contribute papers to the Society, which may be published in our Proceedings.

On looking over the Records of the Society's Proceedings for last session, I find that Zoology has occupied the most prominent place. We have had a series of most valuable original papers on British Zoophytes, by Dr T. Strethill Wright, one of the best observers of the present day. We have also enlisted in our service one who devotes himself now entirely to natural history, Mr Andrew Murray, who has enriched our Proceedings by his Zoological papers, and particularly his contributions on the *Coleoptera* of Calabar, and the *Malapterurus beninensis.* To Dr Cleland we owe some valuable anatomical papers, especially on the structure of Malapterurus; and we also owe our thanks to Dr M'Bain, and Mr Peach, and to Dr John Alex. Smith, our indefatigable Secretary, for their excellent papers.

We have to lament the want of the contributions to Geology which used to come to us from the pens of Fleming and Miller, and we have not been able during last session to induce other geologists, such as Mr Chambers, to favour us with papers.

We may hope that this session will be characterized by greater vigour in all departments.

For myself I must plead guilty to having done little for the Society, chiefly because my botanical efforts are made in connection with the kindred Botanical Society.

I would desire to urge upon all the members the importance of bringing before the Society communications, however short, on the departments of Natural and Physical Science to which they are attached. There are few indeed who cannot contribute something. It is impossible for a careful observer, when he examines natural phenomena, not to detect some point of interest which has been overlooked. Brief notices are always useful, and no one should be deterred from coming forward by are well worthy of our earnest study, whether we regard them as means of exercising our mental powers, or as leading us to higher views of Him who has created all things, and for whose pleasure they are and were created.

The followers of science have sometimes been blamed for attempting to subvert religion by their speculations. There can be no doubt that in former times, and even at the present day, some have started *theories* which have a tendency to shake the faith of weak naturalists. But these are oppositions of *science falsely so called*,—vague theories not founded on facts. There is no fear of true science in its bearings on religion. It is only want of science which produces any jarrings. The more we investigate the wonders of creation, the more we shall see the harmony which subsists between the Word and the works of God.

### I. *Contributions to the Natural History of the Hudson's Bay Company's Territories.* Part II.—*Mammalia* (continued.) By ANDREW MURRAY, F.R.S.E., President of the Botanical Society of Edinburgh.

REIN-DEER (*Rangifer Caribou*).—In my last communication on this subject, I drew attention to the antlers of the American rein-deer,—their peculiar form, their mode of growth, and the habits of the animal,—as bearing on the question of its identity with the Lapland rein-deer, and made some suggestions and speculations, with the hope that they might lead some of my correspondents to inquire more particularly into these points, and give us reliable information upon them, which might enable us to come to a correct conclusion on the subject. I am happy to say, that these observations have had the desired effect, and that, with an additional supply of horns and heads, I have this year received divers remarks on the points I indicated for inquiry. One intelligent correspondent, Mr J. Mackenzie of Moose Factory (from whose communications I have received much satisfaction), goes at some length into the subject, and his information, as to the time of the year when the horns are cast at the different periods of the animal's life, clears up the discrepancies which have been noticed in the statements of different authors on this subject. It will be seen that the casting takes place at different times in the young and older animals. I cannot do better than bring his views before the reader in his own words, particularly as he comes to a different opinion from that which I felt disposed to adopt on one or two of the points which I speculated upon. Mr Mackenzie says—" I have consulted one of our most intelligent natives, a man of about sixty years of age, who has been a deer hunter from his youth, and the result of our " conference" I will presently give you. I send by the ship a deer's head and antlers, which were received about last Christmas, and said to have been killed early in December; it bears some resemblance to the North American species, a representation of which is given in your pamphlet, although the brow antler, however, forms a small angle with the head, and does not come down parallel with it, as in the heads sent you by Mr Hargrave; it has also a second projecting prong, bent near the head, without any terminal points or fingers, but these it would have had, had the animal lived a year or two more; indeed the horns do not cease growing till the seventh year. I do not believe that the brow antler is intended for the purpose of clearing away the snow, but is intended rather as a means of defence against the animal's numerous enemies. The wolf, wolverine, and lynx, destroy them, I am informed, in great numbers; but the animal, on its guard, appears to me to have a good means of defence in his brow antler. Generally, however, he is taken at a disadvantage; when lying down, and off his guard, the lynx their young till the latter end of May or beginning of June, or till the *last snow* is disappearing. The horns begin to grow in about a month; at the end of the year they fall off, being about 8 inches long, and not branched; at the end of the second year they are about 1½ feet long, curved, and with terminal points, and are cast off in spring; the third year the front and brow antlers commence to grow, but are not large at the end of the year, and are cast off again in spring; the fourth year they are larger, but not full-grown, and are cast off in spring; the fifth year they are still growing. and are cast off in *March;* after the fifth year they are cast off in November. The Indian also states, that the antlers have a variety of shapes, and that it is rare to find two exactly alike. With regard to the training or domestication of the rein-deer I can say nothing from my own experience, nor from that of any Indian at this place; but I may mention, that I have recently seen a gentleman who passed many years near the head waters of the River Synauria (a river which falls into the St Lawrence, near the Town of Three Rivers, in Lower Canada), and that he had seen a young rein-deer among the Indians as tame as a lamb; it entered the lodge, and followed its master like a dog; but it was at last killed by the dogs."

Mr Mackenzie's observations will be of use in correcting misconceptions on one or two of the points alluded to by me. It would appear that the American species uses its feet in clearing away the snow from its food, as much as the Lapland species does; and the cup-shaped structure of its feet, as shown in the specimens now sent home, is admirably adapted for this. That it does not use the projecting shovel-like brow antlers for the same purpose I am less willing to admit; the apparent adaptation of their form to this purpose induces me to defer forming a definite opinion upon it until further information be obtained; the rather that, however intelligent and truthful the Indian referred to by Mr Mackenzie may be, his statement is merely negative, and is inconsistent with the observations of such authors (few in number though they be) as notice the point.

As to the identity of the Lapland species with the North

American, we cannot expect to arrive at any correct result, until we have the means of making a more complete comparative examination than has yet been done of the two species alongside of each other. Notwithstanding the greater distance of its locality, we possess both better materials and more accurate information on scientific points regarding the species from North America than that from Lapland. It is to the latter that our inquiries should now be directed, and more accurate information sought for on such points as the periods of growth and shedding of the horns, referred to in my previous communication, and in Mr Mackenzie's letter. His statements on this point have been confirmed to me by Mr Hargrave, who also informs me, that the head with distorted horns, sent last year, which was figured in the first part of this paper, was that of a young animal, not more than two years old. He mentions, that a slight bend is common in the first year; that this becomes of the distorted form above referred to in the second year, but afterwards disappears. I was misled, by the teeth being much worn, into the supposition that it was an old animal. These worn teeth must be the milk teeth; and we thus have incidental information as to the period the animal carries them.

Information on such points becomes of importance, because the North American and Lapland species are so closely allied to each other, that we cannot expect to find distinctions of a prominent nature, and must be content with the accumulation

European representative we are still in doubt. The Scandinavian elk is undoubtedly very near it, if not the same.

The enormous palmation and weight of the horns in this species is very striking. Colonel Smith says that the horns sometimes weigh fifty pounds. The present specimen weighs 32 lb., but that is inclusive of the head. Sir John Richardson, in his account of the animal, records a statement relating to the horns of deer which I think must have originated in some curious mistake. Speaking of the moose deer, he says,—" It is probable, however, that La Hontan in this passage confounds the Canada stag and moose deer together. He mentions the animal being able to run in the summer season for three days and nights in succession, and the excellent flavour of its flesh—facts which apply to the moose deer, but not to the Canada stag; on the other hand, the weight of the horns, which he says sometimes amounts to *four hundred weight*, is true only of the stag." Now, the Canada stag, or *wapiti*, is the representative of the red deer in America, and was indeed long thought to be identical: it is a larger animal than our stag, but smaller than the moose, which is as high as a horse. Large specimens of the male moose are mentioned, which have attained a weight of eleven or twelve hundred pounds; and is it possible that a smaller animal should have horns weighing four hundred weight? I suspect a cypher has been added, and that we should read 40 lb. instead of 400, which would then make it clear that the animal referred to by La Hontan was the moose. With regard to the moose being able to run for three days and nights in succession, an instance of its doing so is recorded in the narrative of Captain Franklin's second journey, where three hunters pursued a moose deer for four successive days, until the footsteps of the deer were marked with blood, although they had not yet got a view of it. At this period of the pursuit, the principal hunter had the misfortune to sprain his ankle, and the two others were tired out; but one of them having rested for twelve hours, set out again, and succeeded in killing the animal, after a further pursuit of two days' continuance. The cause of the footsteps being marked with blood might be from the phalanges of the hoof splitting, or possibly from the hoof becoming worn down by incessant and long-continued action on the icy crust of the snow. We are accustomed to hear of the cattle in long journeys in the Cape of Good Hope and Australia becoming knocked up, and the traveller being arrested in his journey by the failure of his beasts of burden. I daresay many people entertain the idea (as I did myself) that this knocking up was the consequence of physical exhaustion on the part of the cattle. Mr Ford, one of the best zoological draftsmen in Britain, first enlightened me on this point. He had accompanied Dr, now, deservedly, Sir Andrew Smith in one or more of his exploratory expeditions to the interior of the Cape; and he told me that this failure of the cattle was occasioned, not by exhaustion, but by the actual wearing away of the hoof, till blood oozed from it at every pore. The Calahari desert was particularly obnoxious, as it is composed of a slaty formation, highly inclined, which shivered easily off into sharp fragments. It was like walking on bundles of penknives, with their edges placed upwards. The cattle gave in sooner in this desert than in any other district, in consequence of the greater abrasion of the hoofs upon this slaty formation; and, till they grew again, the animal was useless, and scarcely, even to crop its food, would it stir from the spot where it was unyoked. I do not know what length of time would be necessary to incapacitate an ox,—of course, it must be various, according to the extent and nature of the ground travelled over; but although soft snow might protect it longest, it. The whiteness of its colour also is so pure that it is most difficult to discern it on the snow. Sir John Richardson notices that in one of the boat voyages in which he took part along with Franklin, they landed on a rocky islet off Cape Parry, which, although not above 300 yards in diameter, was tenanted by a solitary Alpine hare. The whole party went in pursuit of this poor animal; but it availed itself so skilfully of the shelter of the rocks, and retreated with so much cunning and activity from stone to stone, that none of them could obtain a shot at it, although it never was able to conceal itself from their search for more than a minute or two at a time.

Its flesh is said to be better eating than either the American or European hare.

**QUEBEC MARMOT** (*Arctomys empetra*, Schreb.)—This animal, although recorded as being found in the Hudson Bay Company's territories, would appear to be confined to their southern parts. I have received none from my northern correspondents, but only from Canada, where it would appear not to be rare.

**MUSK RAT** (*Fiber zibethicus*, Cuv.)—This is a very common species in the Hudson Bay Company's territories, and supplies a large portion of the furs sent to this country. Its skin is used as medicine or medicine-bags by the natives, in which state the specimens sent to me have arrived.

**BEAVER** (*Castor Americanus*, Brandt).—Considering the immense number of animals both of this, and more especially of the preceding species, which have for a long series of years been taken for the purpose of supplying the wants of civilized Europe, we might have expected that specimens would be by no means rare in our museums. The contrary is the case, however, so much so that when my friend Dr J. A. Smith a year or two ago wished to compare the semi-fossil bones of a beaver found in a superficial deposit in Scotland with the recent skeleton of a beaver, the comparison could not be made in Scotland from want of a specimen of the recent animal in any of the museums in that country. I applied to Mr Mackenzie to assist us in remedying this deficiency, and he has very kindly done so by sending both a full-grown living beaver, and a fœtus taken from the mother before birth. In sending a living specimen, Mr Mackenzie remarked that it would probably ultimately answer the purpose of a skeleton, should the climate of Edinburgh not agree with the animal's constitution. I had destined it for the pond in the Edinburgh Royal Botanic Gardens, where Professor Balfour could have given those interested in natural history an opportunity of studying its habits at their leisure. It might easily have been kept alive if it once had reached the gardens. There would have been no difficulty in supplying it with birch twigs and branches, its native and proper food; and Mr Mackenzie informs me that it is by no means particular in its food, and that if it had the run of the kitchen (that is, I presume, the opportunity of selecting what it chose from the debris of an ordinary family's table) it would do very well. Unfortunately, it never got the chance of trying the climate of Edinburgh, nor we the chance of trying experiments upon it or its food. It reached London alive, but that was all. It died next morning. It was, however, carefully transmitted to me, and along with the fœtus received last year was presented by me to Professor Goodsir, who has undertaken to make a careful dissection of it, and to communicate anything he might think of interest. There are a number of points in the internal anatomy on which information is wanted, such as the castor, and the glands which produce it, and others which might throw light on some disputed (I cannot call them doubtful) points in its economy and habits. For instance, we know from Hearne, that the usually received notion that the animal uses its tail as a trowel to plaster its work, is merely a vulgar prejudice, arising from its flapping it on the ground occasionally, and more particularly when about to plunge into the water. Now an examination of the muscles of the tail might, were it necessary, throw light upon this point. But I imagine that the whole structure and habits of the animal explain the use of the tail sufficiently even without anatomical assistance. On examining its external peculiarities we find that its fore paws and feet are short and comparatively small and weak, and not provided with a web; the claws are strong, and well adapted for digging, but not equal to those of the hind feet. The hind feet and legs are enormously strong, the fingers united by a strong broad web, the claws excessively developed, and each in the form of a strong gouge. The combination of machinery in the fore and hind legs and feet thus corresponds with what we know of the habits of the animal so far as that can be observed; and the structure of that portion whose working is difficult to be observed in action, or has not been noticed sufficiently, shows what its real working is. Those who have observed the animal in its native haunts, tell us that it uses the fore paws for carrying the mud and stones used in its constructions, and that it carries this stuff between them and its breast, which quite corresponds with their attitude in my dead specimen. It no doubt uses the fore paws for other purposes, as digging, swimming, and walking (for nature seldom or never creates an organ merely to fulfil one purpose). As clearly, the hind paws are much used in digging, but most in swimming;—the powerful hind leg, enormous web foot, and strong claws, would prove this although no one had ever seen the animal using them. Combine these different actions of the fore and hind feet together and see what would be the result. Suppose the animal swimming across its pond or river with a burden of heavy materials clasped to its breast by its fore paws, and powerfully propelled by its hind legs, and that it had no tail or only a common tail—what must inevitably be the consequence? The hind feet would propel the animal rapidly enough—no doubt about that—but where to?—why, to the bottom, for, being overloaded in front, it would be top heavy, and its head becoming directed obliquely downwards the more violent the exertions of the hind feet, the sooner it would reach the bottom, and the deeper its head would be buried in the mud. That this is the necessary and inevitable consequence of the want of the action of the fore paws, will be evident to every one if they will merely fancy what would be the result of their trying to swim with their arms folded; of course, if there is not only the inaction or abeyance of the fore arms to be conquered, but also the weight of a load of mud or stones to be counteracted, a counterpoising lever of more than ordinary power will be necessary, and this is supplied by the broad flat horizontal tail, which is constructed on the best principles for attaining such an object. Were it different or differently placed, the end would not be answered; suppose it vertical like a fish's tail, it would answer equally well as a swimming organ, but not as a counterpoise. It must be powerful, and it must be horizontal, so as to press broadly downwards, and as the purpose here is to increase resistance and friction, and not to diminish it, it is denuded of hair, or nearly so, and covered with polygonal scales. A few scattered hairs occur, interspersed between them, but these are not abraded as they would have been had the tail been used as a trowel. That this is the interpretation of the structure and purpose of the tail is I think self-evident from its fitness. The habit of flapping the tail on the ground before plunging into the water is probably only the mechanical repetition of the action with which it habitually starts into motion, and which in the water is essential to its progress.

The teeth of the beaver are often quoted as good examples of the mode in which rodent teeth grow from the pulp at their base, with a hard enamel-like steel on the outer edge, and softer material on the inner side, and thus have their sharpness and chisel-like form always kept up by the very thing which at first sight would seem to be likely to make them blunt—viz., their constant use. The incisor teeth in the fœtus are conical, thus showing that the chisel form in the visible." In my specimen it is not *thickly* clothed with hairs; it is rather sparingly clothed with hairs, and the scales are very apparent under them. He also says that "its" (the tail's) "upper surface is of a hair-brown colour, considerably darker than any other part of the animal, and contrasts strongly with the inferior surface, which is white." The upper surface of the tail in my individual is not nearly so dark as the back of the body; still, however, as it agrees in all other respects with *Mus leucopus*, I have no doubt that it is that species, and that these differences are only accidental variations in my specimen.

SHREW-MOLE? (*Scalops Canadensis*, Cuv.)—I have had no opportunity of comparing this animal with any named specimens, and my determination is made entirely from the description in Sir J. Richardson's "Fauna Bor. Amer." My specimen agrees, for the most part, with the description in that work; but there are one or two points on which I am not quite satisfied. In particular, the whole of the fore foot is said to have a close resemblance to that of the common mole. Now, although this has a general resemblance, it cannot be said to bear a close resemblance. It wants the sabre-shaped bone of the mole, and the nails are greatly smaller. The description of the nails of the shrew-mole is, that they are large, white, and have a semi-lanceolate form, with narrow, but rather obtuse points. These in my specimen can scarcely (according to my ideas) be said to be large; but large is a word of very doubtful interpretation; what is large to one person may be very small to another; so that, on this item, I must mark my species with a query.

There is one point in the history of the shrew-mole which I should like to see either confirmed or expunged from our books—viz., that although a burrowing animal, it has the singular habit of coming daily to the surface exactly at noon.

*Sorex parvus*, Say.—This shrew may be readily distinguished from other American shrews by its tail being rounded instead of being more or less angular. One might be disposed to think that this is a character of little value, depending merely on the greater or less plumpness of the individual: but it does not appear to be so, and other characters concur with this to establish the species.

This one is certainly not well named; as, though undoubtedly a small animal, it is the largest of the North American species.

*Sorex Forsteri*, Rich.—The tail in this species is quadrangular. It is the smallest quadruped known to the Indians; and I cannot call to mind any quadruped with which I am acquainted, from any quarter of the world, which is smaller. Among the specimens which have been sent me is one which differs slightly from the description of *S. Forsteri*. Its colour is wholly mouse-dun, whereas that of Forsteri is wholly clove-brown on the back. The specimen is in spirits, however; and the clove-brown being, from what we see in other specimens, a tinge of that colour in certain lights, it is probable that the darker colour is merely owing to the medium in which it has been sent; at all events, that the specimen is at most only a variety.

AMERICAN OTTER (*Lutra Canadensis*).—I have received a specimen from the York Factory district, in the shape of a medicine-bag, which is a favourite use of it with the natives.

II. *On New Protozoa.*—(1.) Lagotia producta. (2.) Zooteire areligata. (3.) Corethria Sertulariæ. (4.) *On* Stentor Mulleri *and* Stentor *viridis*, which I had discovered some time before, together with two other species, *Lagotia hyalina* and *atro-purpurea*. The present species, *Lagotia producta*, was found in great profusion in the tanks of Miss Gloag of Queensferry, in August last, and resembles *Lagotia viridis* in its general characters. It has the same long green body, surmounted by a horse-shoe-shaped or two-pronged rotatory organ, each prong formed of a membrane folded together, like the ear of a hare, and edged by a muscular band fringed with vibratile cilia. It inhabits also a similar flask-shaped cell, with bent neck and trumpet-shaped mouth. But the body of *Lagotia producta* is greatly prolonged in comparison with that of *Lagotia viridis;* the colour nearly black, and the gullet a wide sac, and not a spiral canal. In the present species, the neck of the cell has become a long wide tube, greatly disproportionate to the flask-shaped part from which it projects; the whole bearing some resemblance to a long jack-boot. A careful examination of the anatomy of the cell reveals a structure of singular interest and beauty. It consists of three elements—(1.) a horny or chitinous case, lined with (2.) a layer of dark green sarcode, and covered with (3.) a thin layer of colourless sarcode; so that the cell is not a mere extraneous house in which the animal lives, but is a quasi-bony framework, buried in an extension of the living flesh of the animal, and growing with its growth. And this, I believe, holds good with regard to the tubes of other genera of Vorticellina. It is especially to be seen in *Vagincola valvata*, a species which I have described to the Society, and in which the layer of sarcode lining the tube serves to support and partly to form a valve, which rises and falls with the movements of the animal within.

The chitinous case of *L. producta*, or that part of it corresponding to the body of the flask, resembles that of *Lagotia viridis;* but the neck or tube is composed of a spirally-wound ribbon of chitine, the upper edge of each spiral slightly overlapping the lower edge of the spiral arising above and within it, and being slightly everted. The edges have no chitinous connection with each other, but are retained in their places by their fleshy coverings. One might suppose that the tube was formed and gradually increased in length by a continual addition to the length of the spiral ribbon, and that with the increasing age of the animal the number of spiral turns would continually increase. Such, however, is not the case, as I shall proceed to show.

### *Mode of Reproduction in Lagotia.*

As I was anxious to ascertain the mode of reproduction in Lagotia, I was kindly allowed to take away with me several of the stones from the aquarium. These were placed in a large glass vessel of sea-water, and careful daily search was made for some weeks to discover larvæ, but without success, although young Lagotias were beginning to attach themselves to the sides of the glass. At last, I discovered several dark green specks swimming in the water: these were caught one by one, placed in large flat cells, and covered by bell-glasses, to prevent evaporation, where they became developed into Lagotias.

The young of *Lagotia producta*, in its earliest stage (fig. 4), is a short cylindrical body, with rounded extremities of a dark sea-green colour. The surface of the body is marked by coarse striæ, each of which carries a fringe of long lashing cilia, by the aid of which the animal urges itself rapidly through the water, at the same time rotating on its axis. It quickly assumes a more lengthened form (fig. 5), the anterior extremity of the cylinder puts forth a fringe of long cilia, of the animal were completed, the young Lagotia had increased in size, and its tube had become more opaque.

The spiral structure of the tube appears to afford a provision for its growth similar to that found in the articulated shell of the Echinus. In *Lagotia producta*, increase in length of the tube would be effected by the deposition of chitine on both edges of the spiral ribbon, while increase in its calibre would take place by the gradual unrolling of the same. The chitine is probably secreted by the thick inner coat of the tube; while the external coat appears to act, like the "colletoderm" of zoophytes, as a cement for attaching the cell to the rocks. These young Protozoa frequently assembled in clusters, and secreted a quantity of "colletoderm," which glued all their cells into a single mass.

So far, the observation as to the reproduction of Lagotia is in some measure satisfactory; but it still remains to be discovered how the ciliated larvæ are produced. In *Epistylis nutans*, one of the Vorticellina to which Lagotia is allied, an encysting process takes place, according to Stein, by which the animal takes the form of an Acineta. The ciliated head is absorbed; the body is inclosed in a tough tunic; and numerous long capitate tentacles are put forth, which have the property of sucking tubes, and quickly absorb the fluid contents of any animalcule coming in contact with them. Within this Acineta body one or more ciliated embryos are formed, and successively given off, until the substance of the Acineta is entirely exhausted, and it becomes an empty sac. A similar transformation into the Acineta state has been noticed in Vaginicola, a still nearer ally of Lagotia. I have, however, not been able to detect any such change in the subject of this notice.

### 2. *Zooteirea religata.* (Fig. 7.)

This Protozoan is an inhabitant of deep water, and was dredged from the oyster-beds opposite to Newhaven. It was attached in considerable numbers to the concavity of the lower valve of an old oyster-shell, from whence it propagated itself to the sea-weeds of the vessel in which it was confined. Zooteirea may be briefly described as an Actinophrys mounted on a contractile stalk. Actinophrys, again, consists of a globular mass of sarcode, in which may be distinguished two tissues: an internal one, which I shall call "endosarc," enveloped by an external tissue, "ectosarc." The endosarc is dense, loaded with molecular matter and nutritive granules; the ectosarc transparent, and produced into tentacular appendages. Actinophrys has no mouth. Animalcules, seized by the tentacles, are drawn to the surface of the body, the soft sarcode of which becomes depressed, closes over them, and envelops them. They sink into the endosarc, and are absorbed. The endosarc is the *alimentary tissue;* probably also the reproductive tissue. The ectosarc exercises the prehensile function. The tentacular processes of Actinophrys are homologous with those prehensile processes of the "ectoderm" which I have described as existing in several classes of aquatic animals, and to which I have given the term "palpocils," a term which has lately been adopted by my friend Mr Gosse, in his interesting paper on *Sarcodyction catenata.* In Zooteirea, when expanded, the whole of the ectosarc is prolonged into long and exceedingly attenuated palpocils, until the animal assumes the appearance of a globular brush of spun glass mounted on a transparent stalk. When irritated, the animal slowly contracts its stalk until the body is brought close to the surface on which it is attached, and the palpocils are contracted to a mass of little nodules (fig. 7, *b*). The stalk is homogeneous, and is, as are the palpocils, a process of the ectosarc.

its anatomical structure is protozoan, it can be classed in no described family of Protozoa. It consists of three parts: *1st,* An oblong cushion of opaque granular sarcode (fig. 8, *a*) attached to the corallum of the zoophyte, and sometimes containing a few vesicules. *2d,* A long column attached to the cushion (*b*), bearing a brush of short tentacles. This column consists of two tissues; an outer coat thrown into numerous transverse folds or wrinkles (fig. 9, *a*), and an inner core displaying a faintly-marked longitudinal structure (*b*). At the top of the column this inner coat appears to terminate in a brush, or rather mop of from ten to more than forty tentacles (*c*), which have occasionally a slow and rather irregular waving motion, though they are generally at rest. *3d,* There exists, but not invariably, a long, spindle-shaped, and rather curved process of a granular tissue, similar to that of the cushion (fig. 8, *c*), also attached by one extremity to the upper surface of that body, and having at its unattached extremity a clear space, which opens externally by a small oral aperture. This body is often absent, and I have seen it attached alone to the Sertularia. I am therefore inclined to consider it either a gemma or a parasite belonging to Gregarinæ. Although Corethria bears no resemblance in form to any known Protozoan, it has anatomically all the elemental tissues of an Actinophrys. Let us suppose an Actinophrys in which the ectosarc or prehensile tissue is segregated from the endosarc or nutritive tissue, the former, instead of forming a multitude of palpocils, being gathered together into a single large tentacle, surrounded in greater part by a wrinkled cuticle, and undergoing division at its summit into a number of palpocils. Such a structure I have observed in the compound palpocils situated on the tentacles, at the extremities of the rays of *Solaster papposa,* and such appears to be the structure of the "mop" of Corethria. Food taken by the palpocils would be transferred through the soft sarcode composing the centre of the pillar, and digested by the granular endosarc of the cushion below. I have seen the spores of Algæ thus absorbed into and pass through the tentacles of *Ephelota apiculosa.* A like observation has been recorded with regard to the tentacles of an Acineta. From *κόρηθρον,* a mop.

### 4. *On Salpistes (Stentor) Mülleri and castaneus.* (Fig. 11.)

In the last edition of Pritchard's "Infusorial Animalcules" it is stated that *Stentor Mülleri*, "when kept long in glass vessels, fasten themselves to the sides, form a slimy covering around them, and die;" and, further, that Ehrenberg had remarked that "they would gradually congregate, select some particular spot, and then attach themselves, evincing, as it were, not only a degree of sociality, but a mental activity." In their apprehension of these facts I believe the authors above quoted to be mistaken. It is well known that many aquatic animals have the power of secreting masses of viscid gelatinous matter, which does not readily undergo decomposition, to serve as a nidus for the protection of their ova. Thus the nudibranchiate and other molluscs deposit on stones and weeds long convoluted ribbons of clear firm jelly filled with their eggs, which remain therein until hatched. Many insects, aquatic in their earlier stages of existence, adopt the same mode of protecting their young. In the genera *Sertularia*, *Plumularia*, *Campanularia*, and *Laomedea*, species also are found in which the young undergo partial development whilst still contained in gelatinous cases attached to the exterior of the reproductive cells, as I have already described to the Society in the case of *Laomedea lacerata*. Other animals employ the same matter to form envelopes or loricæ, jelly. It then immediately proceeds to multiply itself in geometrical proportion by fissure until masses are formed, which, under favourable circumstances, attain a diameter of three or four inches, and consist of aggregations of many thousands of zooids. In this Protozoan the division is not complete; the zooids are united by fine threads, which permeate the gelatinous mass, and are homologous with the stalks of Epistylis. These threads also appear to have the property of transmitting nervous impressions through the whole mass of this compound animal, and rendering the movements of the associated zooids consentaneous.

When in England some years ago, I found in one of my fresh-water aquariums a great number of specimens of *Stentor Mülleri*, each one of which was surrounded at its base by a flocculent deposit similar in structure to the lorica of *Ophrydium versatile*, and into which the animal could withdraw itself. At first I considered that this state was the result of disease, but further experience showed that the deposit was never absent. Many of the animals inhabited a tall gelatinous pillar, by which they raised themselves considerably above the surface on which they grew (fig. 11). Others by fissure had formed colonies, which were attached to the glass, or hung downwards while floating on the surface of the water; others, again, were swimming naked in search of sites for future erections; but no fixed animals were found to be destitute of a lorica. I have repeatedly met with this animal since, and always in the same loricated state.

In the summer of 1857, a small species of Stentor, of a deep chestnut colour, occurred in the pond of the Edinburgh Botanical Gardens, which is in the habit of secreting a lorica like that of *Stentor Mülleri*. This species, which I have called *castaneus*, selects the tips of the shoots of Myriophyllum for its abode, and glues all the opening leaflets together with a mass of jelly, from which the zooids protrude their wheel-bearing heads. The possession of a lorica removes *Stentores Mülleri* and *castaneus* from the family Vorticellina to that of Ophrydina, which (says Ehrenberg) "includes true Vorticellæ or Stentors inclosed in a gelatinous membranous little box" or shell. In the last family, a new genus will have to be formed for their reception, for which I propose the name of *Salpistes*, from σαλπιστής, *a trumpeter*.

Since the above was written, my friend Mr Alder has informed me that he has also discovered *L. producta* near Tynemouth.

### III. *Observations on British Zoophytes.*—(1.) *On the Reproduction of* Turris neglecta. (2.) *On the Development of* Hippocrene (Bougainvillea) Britannica (?) *from* Atractylis (Eudendrium) ramosa. (3.) *On the Development of* Hydra Tuba (Strobila) *from* Chrysaora. By T. Strethill Wright, M.D.

*Description of Plate* III.

Fig. 1. *Clavula Gossii*, proles *Turris neglectæ*.
2. *Hydra tuba* (*Strobila*) in various stages. 3. Corallum of same.

#### 1. *On the Reproduction of* Turris neglecta.

The only observations that we have as to the reproduction of the gymnopthalmatous Medusæ are those of Mr Gosse with regard to *Turris neglecta*. He is the pioneer who first actually witnessed, or rather caught a glimpse of, the reproduction of a hydroid zoophyte from a recognised species of Medusa. In September 1852, he saw the oval purple gemmules of *Turris neglecta* escaping from the walls of the ovaries, and dropping down to the bottom of the vessel in which they were confined, where they moved slowly about by means of their cimen of *Turris neglecta* laden with dark crimson ova. This prize I accommodated with a commodious apartment, in which it might exercise the duties of maternity. After a weary delay of nearly a fortnight, the young made their appearance as dark crimson ciliated larvæ. These underwent the changes so well described by Mr Gosse; but instead of being destroyed by starvation in their infancy, the four-armed polyps underwent a further development into a zoophyte resembling *Clava repens* (fig. 1, Plate III.) The young of *Turris neglecta*, which I now place on the table, and to which I have given the name of *Clavula Gossii*, may be described as follows:—

*Clavula Gossii* (Proles *Turris neglectæ*). Polypary creeping, sheathed in a chitinous polypidom. Polyps minute, seated on short stalks, spindle-shaped, furnished with about twelve tentacles; upper row of tentacles long, filiform, four in number, erect; rest of tentacles scattered, shorter, inclined upwards; colour crimson.

### 2. *On the Development of* Hippocrene (Bougainvillea) Britannica *from* Atractylis (Eudendrium) ramosa.

This paper appeared as a note to Dr Wright's paper on Atractylis on page 449, Vol I., of the Proceedings.

### 3. *On the Development of* Hydra tuba (Strobila) *from* Chrysaora.

In September last, I extracted a larger number of young from the reproductive sacs of Chrysaora. The young in their first stage are (as has been repeatedly observed) swimming ciliated larvæ. The greater part of these attached themselves to the surface of the water, and hung downwards as globular sacs seated on long thin pedicles or stalks (Plate III., fig. 2). The pedicles were surrounded by a thick and very transparent gelatinous case, corallum, or polypidom. The globular sac acquired a mouth, and afterwards four, eight, sixteen tentacles successively. As the Hydra grew, it produced additional attachments from its body. The bases of these attachments in the fully-developed Hydra appeared as a number of closely-aggregated circles (fig. 3), in which the four tissues, colletoderm (*a*), corallum (*b*), ectoderm (*c*), and endoderm (*d*), could be distinctly made out in those specimens attached to surfaces of glass. It appears, from the above observations, that the *Hydra tuba* is not a naked polyp, as hitherto described.

### IV. *Specimens of the Lantern Fly of British Honduras were exhibited* by J. A. Smith, M.D.

These appeared to be the *Fulgora laternaria*, Linn., and were sent for exhibition by Mr James Banks, Prestonpans. It seemed, Dr Smith said, to be still undecided among naturalists whether these flies were really luminous at times or not. Other luminous so-called fire-flies belonged to the class of beetles (*Coleoptera*). It was of importance, therefore, that the undoubted evidence of eye-witnesses should be produced; and it was suggested that Mr Banks be invited to write to his correspondents in Honduras for information on the subject.

### V. *Notes of Fossils from the Old Red Sandstone of the South of Scotland.* By John Alex. Smith, M.D.

A specimen of a fossil plant was exhibited from the Upper Old Red Sandstone of Roxburghshire. It was found last autumn in the Denholm Hill quarry, in the white rock of its upper beds. The plant was apparently a *Fucus* or sea-weed; its stem was rather more than one-fourth of an inch in width, and divided dichotomously into numerous branches, covering part of the surface of the stone for about a foot or so in length. The few plants found in this locality had been recently described by the Rev. Mr Duncan, Denholm, in a sketch of the geology of the district contained in a work on the "History and Antiquities of by about ¼ in its greatest breadth, and exhibits a transverse, or rather radiating, series of eight depressions, gradually increasing in depth, and showing lines of punctures, corresponding, he supposed, to the rows of the projecting teeth; and the fossil was all the more strikingly displayed from the colour of the sandstone being completely discharged around the cast, which appears as a patch of white, in the dull red of the surrounding stone. He sent the fossil for examination to Mr Hugh Miller a few months before his lamented death, and received, in reply, the following interesting note:—

"SHRUBMOUNT, *30th June* 1856.

"MY DEAR SIR,—Your fossil is the Old Red *Ctenodus* of Agassiz (his Coal Measure *Ctenodus* belongs to a different genus); but though he gives *it* (his Old Red *Ctenodus*) a generic standing of its own, it is in reality a portion of the previously described Dipterian genus. The *Dipterus* had two triangularly arranged groups of teeth on its palate, and your specimen is a remarkably distinct impression made by one of these I could show you groups of teeth, were you to do me the pleasure of looking in upon me here, that would fit into your impression well nigh as exactly as a seal would into the wax which it had stamped. Your specimen is the second of *Dipterus* which I have now seen from the *Upper* Old Red Sandstone. The first,—a gill cover,—is in the collection of Mr Patrick Duff of Elgin. I have been prostrated by another attack of my old enemy, inflammation of the lungs, and, after being confined to my bed for a fortnight, am but slowly recovering. Portobello has many visitors at present; but I have seen little of scientific men, and have had little of scientific conversation for the last three quarters of a twelvemonth; and should you chance to come this way, it would gratify me much to have half an hour's talk with you among my fossils. Some of my Old Red ones would, I am sure, cast not a little light on the detached organisms of your south-country beds.—I am, my dear Sir, yours very truly,

"HUGH MILLER.

"DR JOHN A. SMITH."

*Wednesday, 22d December* 1858.—WILLIAM RHIND, Esq., President, in the Chair.

J. W. Laidlay, Esq. of Seacliff, and John M. Mitchell, Esq., Mayville, Trinity, were elected members of the Society.

The Office-Bearers for the session were elected as follows:—

*Presidents.*—Andrew Murray, Esq., W.S.; William Rhind, Esq.; Thomas Strethill Wright, M.D.

*Council.*—W. H. Lowe, M.D.; Alexander Rose, Esq.; George Logan, Esq., W.S.; John Hutton Balfour, M.D., Professor of Botany, University; James M'Bain, M.D., R.N.; John Coldstream, M.D.

*Secretary.*—John Alexander Smith, M.D.

*Assistant Secretary.*—James Boyd Davies, Esq.

*Treasurer.*—William Oliphant, Esq.

*Honorary Librarian.*—Robert F. Logan, Esq.

*Library Committee.*—John L. Stewart, Esq.; Alexander Bryson, Esq.; Patrick Dalmahoy, Esq., W.S.

The following Donations to the Library were laid on the table, and thanks voted to the donors:—

1. Annales des Sciences Physiques et Naturelles d'Agriculture et d'Industrie, Publiées par la Société Royal d'Agriculture, &c., de Lyon, Tomes VI., VII., VIII., IX., X., and XI.—From the Royal Society of Agriculture and Industry of Lyons. 2. Geological Survey of Canada—Report of Progress for the years 1853–56, printed by order of the Legislative Assembly, Toronto; with quarto Atlas of various lakes and rivers.—From Sir W. E. Logan.

The following communications were then read:—

I. Mr Rhind exhibited a specimen of black shale, displaying a branch of *Lepidodendron* several inches in length, with the *Lepidostrobus* attached to its extremity, which was found by Mr R. H. Traquair, in the beginning of August last, in a stratum of very fissile black shale exposed in the bed of the Water of Leith, a little below the church at Colinton. This shale abounds in the stems of *Lepidodendra*, in detached *Lepidostrobi* and *Lepidophylli;* and in what seems to be impressions of very of the Eolidæ contains at its extremity a small ovate vesicle, communicating, through the biliary sac, with the digestive system, and opening externally by a minute aperture at the end of the papillæ. This vesicle is found crowded with compact masses of thread-cells; which masses, in *Eolis nana*, consist of aggregations of small and large thread-cells, identical in size and shape with those of Hydractinia,—on which this Eolis preys,—not contained in capsules, but cemented together by mucus. When we consider that each of the vesicles is in indirect communication with the stomach, I think we may, without presumption, suggest that the masses of thread-cells found in *Eolis nana* are *quasi* fæcal collections of the thread-cells of Hydractinia, which, protected by their strong coats, have escaped the digestive process. In corroboration of this view, I may mention that the thread-cells of *Eolis papillosa*, as figured in the work of Alder and Hancock, have a perfect resemblance to those found in the Actinias, which last animals furnish an Abyssinian repast to these carnivorous mollusca." Dr Wright afterwards found that, as to the above idea, he had been anticipated by his friend Mr Gosse, who, in his "Tenby," after noticing the existence of the thread-cells in the papillæ, remarks:—"The inquiry I suggest would be, How far the presence of thread-cells might be connected with the diet of the mollusc? And whether, seeing the forms of the missile threads vary in different genera of zoophytes, the forms of the corresponding organs in the papillæ of the Eolides would vary if the latter were fed exclusively first on one and then on another genus of the former." He afterwards found that Mr Huxley had also doubted, previously to Mr Gosse and himself, whether the thread-cells of the Eolidæ were not adventitious. Here were three independent observers to whom the idea has suggested itself; Mr Huxley had first hinted it; Mr Gosse suggested it, and how it might be found to be true; Dr Strethill Wright also had suggested it, and given two instances in corroboration of his opinion, and to-night he proceeded to detail observations which would, he hoped, entitle it to be enrolled as a proved fact in the records of science. 1*st*, A specimen of *Eolis nana* was brought home from Morison's Haven, on a shell covered with Hydractinia, taken from a rock-pool, in which was a profuse growth of *Campanularia Johnstonii*. The papillæ of this Eolis contained the two kinds of thread-cells which are found on Hydractinia, together with the large thread-cells which occur within the reproductive capsules of *C. Johnstonii*. 2*d*, An *Eolis coronata* was taken at Queensferry, on a massive specimen of *Coryne decipiens*, which was very abundant there. The thread-cells of *C. decipiens* were very distinctive, being very large, oval, and containing a four-barbed dart. The thread-cells of the Eolis and Coryne were carefully compared together, and were found to be identical. 3*d*, Dr M'Bain and Dr Wright found an *Eolis Drummondii* on a fine specimen of *Tubularia indivisa*. They first carefully examined the thread-cells of the Tubularia, and found four kinds, two (large and small) of a nearly globular shape, each containing a four-barbed dart, and two (large and small) of an almond shape, the larger one containing a thread, furnished with a lengthened brush of recurved barbs. They then examined the papillæ of the Eolis, and found the ovate sacs filled with an indiscriminate mixture of all the four kinds of thread-cells found on *Tubularia indivisa.* *4th*, Dr M'Bain and Dr Wright found a specimen of *Eolis Landsburgii* on *Eudendrium rameum.* *Eudendrium rameum* was furnished, as to the bodies of its polyps, with very large bean-shaped thread-cells, in which an unbarbed style could be detected, while the tentacles of the polyps are covered with exceedingly minute cells. They compared the thread-cells of the Eudendrium with those found in the sac of Eolis, and found both kinds identical. *Lastly*, Dr Wright had kept the specimen of *Eolis Drummondii* above-mentioned fasting for a long time, and then introduced it to a large specimen of *Coryne decipiens* fresh from the sea. The next morning every polyp of the zoophyte had vanished, and the ovate sacs of the Eolis were packed with the distinctive thread-cells of the Coryne, mixed with a few thread-cells of *T. indivisa*, the remains of its former feast. He also found the thread-cells of *C. decipiens* in the alimentary canal. It was at one time supposed that thread-cells, or Cnidæ, as Mr Gosse had named them, were only to be found in the hydroid and helianthoid polyps and the Medusæ; Professor Allman afterwards discovered them in a species of Loxodes, a protozoan animalcule; and Dr Wright had the good fortune to find them on the tentacles of an annelid, *Spio seticornis*, and also on the tentacles of Cydippe, one of the Ctenophora. Since then he had observed them on the very minute tentacles of Alcinöe, another of the Ctenophora. In all these classes of animals thread-cells were developed within the ectoderm or skin of the animal, and in many, such as in *T. indivisa*, each within a distinct and very apparent sac, and not in connection with the digestive system. The type of structure, moreover

### III. *Notice of a Skull of the* Troglodytes Niger, Desm., *the Chimpanzee, found in a "Devil-house," Old Calabar, Africa.* By JOHN ALEXR. SMITH, M.D.

The skull on the table was one of those interesting objects of natural history, for the exhibition of which the Society is indebted to the zeal of our Treasurer, Mr William Oliphant, and, through him, to the missionaries of the United Presbyterian Church at Old Calabar. It was sent home by Mr Archibald Hewan, the Mission surgeon, and was entitled by him the skull of an ape, taken from an old "devil-house" at the Guinea Company's villages, about a hundred miles from the mouth of the Old Calabar River. It is the skull of an adult Chimpanzee, indicated by its general appearance, the calvarium smooth and rounded, the partially obliterated sutures, and the full complement of teeth, well ground down on their summits. These teeth are similar in number to those of man. The skull measures 19 inches in circumference, in the line of the alveolar processes of the incisor teeth in front, and the occipital protuberance behind; and rather more than 7 inches in length between the same points in a straight line. The skull of an adult male is described as measuring 8½ inches in length; this is probably therefore the skull of an old female,—the muscular ridges being but slightly marked; the space between the incisor teeth and the canines is very slightly developed, measuring little more than 1-10th of an inch. The characteristic high superciliary ridge of the Chimpanzee is strongly marked; showing at a glance the very vague character of any deductions as to the amount of brain, to be drawn from the extent of what is called the facial angle in a cranium such as this. This formidable animal stands some 3 feet 10 inches high, the male reaching the height of 4 feet from the top of the head to the sole of the heel in a straight line. You are aware these creatures have been frequently described as reaching a much higher stature (it was believed with increasing age), but it now appears from the recent researches of naturalists, both in America and in this country, that there are at least two distinct species of Chimpanzee, inhabiting in one instance the same district of country, one of which is much larger than the other. The cranium now exhibited belongs to the smaller species. The larger, the *Troglodytes gorilla*, stands 5 feet high and upwards. The *T. Niger* is found in various parts of the western coasts of tropical Africa, as the Guinea coast and Angola, and also between these distant places, as in this instance on the Calabar River, thus showing a pretty extensive range. The large Chimpanzee, or *Troglodytes gorilla*, has been brought from the neighbourhood of the Gaboon River, nearly under the Line, where the *T. niger* has also been procured; but future inquirers will probably give the former also a much more extended range, as the huge Chimpanzees, said to have been seen in various parts of western tropical Africa, will probably turn out to be the *gorilla;* and what have been supposed to be merely exaggerated tales may thus have more truth in them than we have been inclined to give the narrators credit for. The killing of one of those formidable creatures is considered a great feat by an African brave; and in this instance, apparently, the skull had been preserved as of great value, if not also for worship. You observe there is a piece of copper wire, 1 foot 11 inches long, and 2-10ths of an inch thick, which is wrapped twice in a vertical direction round the skull, passing through the temporal fossæ of each side, behind the superciliary ridge above, and the nasal fossæ below. Hammered copper wire is the current money of this part of Africa; so the amount of metal used in ornamenting this skull shows the high value the owner had placed on it. It was taken, I have erected; it is left open at one end, and in it the valuables of the deceased are placed—his furniture, clothes, utensils, and food. These, however, are shortly after, more or less damaged or broken, for one of two reasons, if not for both—either to kill the articles themselves (for in Calabar all things are supposed to possess life), that their spirits may go to benefit the spirit of the deceased,—or, to prevent people from sacrilegiously stealing them. The whole being intended as an offering to the *fetish*, or evil spirit, and left as sacred to the memory of the deceased. As in other parts of Heathendom, an evil spirit is worshipped, as well as a good spirit; and fear, which is the moving principle of their worship, naturally makes more respect be paid to the bad than to the good, the vengeance of the former being most feared, and therefore greater pains are taken to propitiate his anger. The principal *fetish*, or evil spirit, worshipped in the houses of Old Calabar is, strange to say, a *human skull* without the lower jaw, which is tied by bands of plaited leaves, crossing one another, to the top of a thick block of wood, the upper part of the rounded stem of which is also wrapped about with bands of plaited leaves or thongs. Dr Sommerville kindly showed me one of these in his possession. We may therefore suppose this skull of the *T. niger* had been offered as a highly valued propitiatory offering to the *fetish*, if not also worshipped as the representative of the much-feared *fetish* or evil spirit itself in the home of the man from above whose grave it was taken.

Crania of the two species of Chimpanzee are described by Professor Owen in the Transactions of the Zoological Society of London. Captain Wagstaff, who brought them to Bristol, stated "that the natives, when they succeed in killing one of these Chimpanzees (the gorilla), make a *fetish* of the cranium. The specimens bore indications of the sacred marks in broad red stripes, crossed by a white stripe, which could be washed off. Their superstitious reverence of these hideous remains of their formidable and dreaded enemy adds to the difficulty which a stranger has to contend with in procuring specimens." This quotation shows how general is the feeling of superstitious dread which appears to exist with regard to these Chimpanzees, creatures, which of all the lower animals, in their structure and general appearance, make the nearest approach to man.

## IV. *Notices of some of our Rarer Birds.* By John Alexr. Smith, M.D.

(1.) Notice of the *Tetrao medius*, *T. hybridus*, or *Urogallus hybridus* of Authors. This beautiful bird was formerly believed by some Naturalists to be a distinct species, and by others merely a hybrid between the Capercailzie and Black Cock. The specimen now exhibited was killed about the 23d of November, by Major J. W. Wedderburn, near Loyal House, Alyth, Perthshire. The bird is a male; it is intermediate in size between the capercailzie (*T. urogallus*), and the black grouse (*T. tetrix*), measuring 28½ inches in length, and weighed 5 lbs. 10 oz. The general appearance of the plumage is darker than the capercailzie; the bill is black like the black grouse; the head and neck, which shows the bearded throat of the capercailzie, is of dark colour, with reddish purple reflections, especially brilliant on the breast; there are a few white feathers on the lower part of the breast and abdomen, as in the capercailzie; and the tail has the lateral feathers the longest, as in the black cock,—the external ones being slightly curved outwards. The stomach was filled with buds of heather, and not of the pine, which is the favourite food of the capercailzie. Birds of this kind have been very rarely observed in Scotland of late years;- they are said, however, to have been occasionally noticed in ancient times. Lloyd mentions that they occur in Norway, but are not common; and they are sometimes sent, Yarrell informs us, with the capercailzie to the London markets.

(2.) Dr Smith exhibited a specimen of the *Lanius excubitor*, Penn., the Great Grey Shrike, which was killed a few days ago by Dr C. Nelson at Pitcox, near Dunbar. The bird is a young male, and may be considered as only an occasional winter visitor to Scotland.

(3.) Two specimens of the Pintail Duck, *Dafila caudacuta*, Gould, hen, *Gallinula chloropus*, and a water ouzel, *Cinclus aquaticus*, both apparently swallowed very shortly before the fish was captured. The pike weighed 30 lbs., and measured 4 feet 4 inches in length. It was taken on the estate of the Duke of Atholl, in Perthshire, and is now preserved in the valuable Anatomical Museum of the University.

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*Wednesday, 26th January* 1859.—T. STRETHILL WRIGHT, M.D., President, in the Chair.

The Donations to the Library were as follow:—

1. Proceedings of the Academy of Natural Sciences of Philadelphia, 1857-8; Notice of some Remarks by the late Mr Hugh Miller.—From the Academy of Natural Sciences of Philadelphia. 2. Mémoires de la Société Imperial des Sciences Naturelles de Cherbourg, Tome IV., 1856. — From the Society. 3. Graduation Address, August 1858; On the Structure and Growth of Timber, and on the Dry Rot in Wood; Notice of the Palm House in the Royal Botanical Garden at Edinburgh, by Professor Balfour. — From the Author. 4. Quarterly Journal of the Geological Society of London, No. 56, November 1858.—From the Society. Thanks were voted to the donors.

The following communications were then read:—

I. *Contributions to the Natural History of the Hudson's Bay Territories.* Aves.—Part I. (*Numerous Specimens were exhibited.*) By ANDREW MURRAY, Esq.

Before commencing the enumeration of the birds, I should wish to make an ample preliminary acknowledgment of the assistance I have received in determining them, from our celebrated ornithologist Sir Wm. Jardine, Bart., and also from Dr J. A. Smith of Edinburgh. Their extensive knowledge and familiarity with the subject have saved me much labour; and wherever the species were difficult of determination, the reader has the satisfaction of knowing that it is introduced in accordance with the careful examination and deliberation of these gentlemen as well as myself.

*Archibuteo Sancti Johannis*, (Gmel.)

Received both from Severn House and Trout Lake Station.

Very near our own *Archibuteo lagopus*, or rough-footed falcon; indeed, the pale-coloured specimen scarcely differs from some European specimens of that bird.

*Falco peregrinus* (Gmel.), (Peregrine Falcon).

Trout Lake Station and Severn House, Hudson's Bay.

Sir J. Richardson says this bird is frequent in the barren grounds. Sir W. Jardine tells me it is the *Falco anatum*, Bonap., of the American ornithologists. Well known at New Jersey from the havoc it makes among the water-fowl in winter. Mr Ord says, that the ducks when struck by it are lacerated from the neck to the rump.

*Falco candicans* (Gmel.), (American Gyr Falcon).

York Factory.

A constant resident in Hudson's Bay territories, known as the "speckled partridge hawk," and the "winterer."

*Circus cyaneus* (Linn.), (var. *Hudsonicus*); or it may stand *C. Hudsonicus*, (Linn.)

From Moose Factory and Severn House.

The male varies from the European specimens, in the upper parts being darker, and in the lower breast and the belly being barred at wide intervals with pale sienna,—agreeing in this respect with the figure given by Bonaparte in his continuation of "Wilson's North American Ornithology." The young male differs in the darker general plumage and the deeper tint of the sienna on the under parts.

*Nyctea nivea* (Daud.), (Snowy Owl).

York Factory.

Two beautiful specimens received; one wholly white without a single dark spot.

*Surnia funerea* (Gmel.), (Hawk-Owl).

Trout Lake Station, Severn House.

*Asio brachyotus*, (Short-Eared Owl).

*Agelaius phœniceus*, (Vieillot.)
Hudson's Bay.
This showy bird winters in vast numbers in the southern parts of the United States and Mexico. Its range to the north does not pass the 57th parallel.

*Agelaius xanthocephalus*, (Bonap.)
From Hudson's Bay.

*Turdus migratorius*, (Linn.), (American Robin).
Severn House, Trout Lake Station.
The colour is unusually bright in the specimens received.

*Seiurus Noveboracensis* (Bonap.), (*aquaticus*, Sw.)
Severn House.

*Anthus Ludovicianus*, (Gmel.)
Hudson's Bay.

*Sylvicola æstiva*, (Gmel.)
Hudson's Bay, Trout Lake Station, Severn House.
Known throughout the whole of the fur countries.

*Sylvicola striata* (Gmel.), (Blackpoll Warbler).
Hudson's Bay, Trout Lake.

*Sylvicola parus.*
Severn House, Trout Lake.

*Otocorys cornutus* (Sw.), (Shore Lark).
York Factory, Severn House, &c.
Appears common.

*Plectrophanes nivalis* (Linn.), (Snow-Bunting).
Severn House, Trout Lake Station, Hudson's Bay.
Only goes to the south when the snow becomes deep.

*Plectrophanes Lapponica*, (Linn.)
Trout Lake Station and Severn House.
Like the last, is common to the northern regions of both Europe and America.

*Plectrophanes pictus*, (Sw.)
Severn House.
Seems scarcer than the others. Sir J. Richardson mentions that he had only obtained one specimen. Three have been sent to me.

*Zonotrichia leucophrys*, (Gmel.)
Severn House, Hudson's Bay.

*Zonotrichia albicollis*, (Gmel.)
Hudson's Bay.
This species winters in the southern parts of the United States. Among the Cree Indians it bears the euphonious appellation of Oochaechimmenaw-kaw-mawkaw-seesh.

*Spizella monticola* (Gmel.), (*Emberiza canadensis*, Faun. B. Am.)
Severn House.
This bird winters in the United States.

*Linota borealis* = *canescens* (Gould).

Severn House.

The same bird known in this country as the Mealy Redpoll.

*Loxia leucoptera*, (Gmel.)

Hudson's Bay, Severn House, and Trout Lake Station.

*Corythus enucleator* (Linn.), (Pine Grosbeak).

Severn House.

*Scolecophagus ferrugineus*, (Gmel.)

Severn House, Trout Lake.

The most northern species,—called Rusty Grakle by Americans. The male is not rusty, but the female has a ferruginous tinge.

*Lanius septentrionalis*, Gmel. = *borealis* of Vieillot, "Orn. Amer. Sept.;" but he unfortunately gave the same name to a European bird in his "Faun. Franc.;" Gmelin's name, therefore, should stand. It is very difficult to make out the birds of this genus; and there almost seems reason to look upon the American species as varieties of the European, but ornithologists have accepted them as different.

Trout Lake Station and Severn House.

*Tyrannus borealis* (Sw.), (*T. Cooperi*, Bonap.)

Hudson's Bay.

(One specimen.) A rare bird, and to be seen in very few collections.

*Colaptes auratus*, (Linn.)

Trout Lake and Hudson's Bay.

One of the woodpeckers; but as it feeds on ants, and therefore does not require so much labour to get its food as the other woodpeckers, its bill is less suited for such work. It is only a summer visitant to the Fur countries.

*Apternus tridactylus*, (Sw.)

William in his inquiry. The above synonymy shows the result to which he has come.

I also particularly drew the attention of my friends to the white-tailed grouse in relation to its affinity to this species, but no specimens of it have as yet been received. Mr A. M'Donald, stationed at Little Whale River, however, writes me as follows on the subject:—"I am not aware that the white-tailed grouse is to be found in this locality. We have two sorts of the ptarmigan—the large one, which is generally found among the willows, is, I believe, the willow grouse. The other is much smaller, and confines itself almost entirely to the rocks.* This latter may be the white-tailed grouse to which you refer. I have never seen it in summer, and indeed they do not, I believe, make their appearance till after a considerable quantity of snow has fallen. They are of about the size of the common pigeon." He adds, "I will be able to procure good specimens of both these, and, if possible, in the various stages." As specimens of this white-tailed grouse are exceedingly scarce in museums in Britain such a supply will be acceptable.

*Tetrao Canadensis*, (Linn.)

Trout Lake and Hudson's Bay.

*Tetrao phasianellus*, (Linn.)

Trout Lake Station.

The *Tetrao obscurus* (Rich. and Sw.), or Dusky Grouse of the Northern Zoology, has not yet been received.†

*Porzana Carolina* (Linn.), (Carolina Rail).

Severn House.

*Pluvialis Virginiacus*, (Borkh.)

Trout Lake Station and Severn House.

The American representative of our golden plover, specifically distinguished from it by its lesser size, and the axillary feathers being dusky, instead of white. Like our own golden plover, this bird is highly prized as food.

*Charadrius semipalmatus*, (Kaup.)

Trout Lake Station and Severn House.

Plentiful in Arctic America.

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* This smaller bird, if not the white-tailed species, will be *L. mutus* (Leach). or common ptarmigan of Great Britain. The white-tailed bird cannot be mistaken, none of the tail feathers being *black*, as in the other two species.

† *Tetrao obscurus* (Say), and the *Tetrao obscurus* (Richard and Swain). Fauna B. Am., are quite distinct, and specimens of the latter from northern latitudes are much wanted.

*Squatarola helvetica*, (Linn.)
Severn House.
This may be looked upon as only a northern state of our grey plover. My specimens are in full *breeding plumage*, and the ground colour of all the upper parts nearly white; certainly appears to be influenced by climate.

*Strepsilas interpres*, (Linn.)
Hudson's Bay and Severn House.
A citizen of the world.

*Grus Canadensis*, (Temm.)
Trout Lake Station.

*Botaurus lentiginosus* (Montag.), (American Bittern).
Severn House.

*Numenius Hudsonicus*, (Lath.)
Severn House.

*Tringa alpina*, (Linn.)
Severn House.

*Totanus melanoleucus* (Gmel.), (*vociferus*, Sab.)
Severn House.
The specimens received agree with Gmelin's description of the breeding plumage, but differ somewhat from those usually seen, which generally come farther from the south.

*Totanus flavipes*, (Vieill.)
Severn House.

*Limosa fedoa*, (Linn.)
Hudson's Bay.

*Limosa Hudsonica*, (Lath.)
Severn House.

*Phalaropus lobatus*, (Ord.)
Severn House.

*Anser hyperboreus* (Gmel.), (Wavey; Snowy Goose).
Moose Factory and Severn House.

to their success in hunting them. Three skins have been received, which appear to belong to three different species; the one of middle size being without doubt the true Canada goose. The smallest one differs in the form of the bill, which is more Bernicle-like; it resembles *B. Hutchinsii;* and Sir William Jardine informs me it agrees very exactly in size, &c., with a bird from Mexico, described by Cassin, from the Philadelphia Museum, under the name of *parvipes*. And he adds,—" Its being from Mexico is no drawback, the Philadelphia Museum possesses only one specimen, and that would be migratory." The largest specimen seems also distinct, and does not appear to have been described; and as it is obvious that, whether it be really a new species or merely in a different state of plumage, it must, when it becomes known, be sooner or later described and made identifiable as a variety, if not as a species, I think I can do no harm in describing it, and giving it a provisional cognomen.

*Bernicla leucolæma*, (Murray). (Plate I.)

Beak black; head and greatest part of the neck black; chin and throat white, the white extending upwards and backwards beyond the ear coverts, and also extending downwards along the under side of the neck almost to the end of the black portion, but tapering away and becoming narrower and somewhat interspersed with black feathers as it extends downwards; the under eyelid broadly white; the white on the cheeks, &c., without black flecks; the black on the fore part of the head and behind the white space flecked with white; the back and the wing coverts, the secondaries and tertials light brown, with lighter coloured edges to the feathers; primaries dark brown; tail feathers black; the rump black; upper tail coverts white; lower part of the neck pale dirty lavender; upper part of breast still paler; lower part and belly almost white, except a broad pale lavender-coloured band across the middle, just before the tops of the thighs, or, perhaps, I should rather express it as breast and belly pale lavender-coloured, with a broad white band across the breast; vent and under tail coverts white; legs and first phalanges pale brown, probably paler when in life; remainder of the phalanges and interdigital membranes bright yellow, sparingly spotted here and there with black or brown. Length, 40 inches.

Its general appearance is very much the same as that of the

Canada goose. The following are the particulars in which it differs:—

In colour.—In the Canada goose the white cravat does not extend downwards along the under side of the neck, but is quite abruptly defined, and cut off; in *B. leucolæma* it does, so as to give the appearance not only of a white cravat under its chin, but also a white frill or shirt appearing in front down its black waistcoat. In the Canada goose the white cravat is flecked more or less with blackish specks; in *leucolæma* it is wholly white. In the Canada goose, the black head in front of, and above the white cravat, is wholly black; in *leucolæma* it is flecked with an occasional white speck, and most so where it joins the upper mandible both in front and on each side. In the Canada goose the space between the *rami* of the lower mandible is black or blackish; in *leucolæma* it is pure white. The white on the lower eyelid is comparatively broad and distinct in *leucolæma;* in the Canada goose it is a mere line like a thread.

The general tone of the plumage of the body, both above and below, is considerably paler in *leucolæma* than in the Canada goose—the black primaries having become brown, the brown back having become somewhat fawn-coloured, and the fawn-coloured under side having become dirty white, with a pale bluish or lavender-coloured broad band stretching across the belly between the two thighs.

The black on the neck extends rather a shorter distance surements are taken from the specimens which I have received from Hudson's Bay, one of each bird, and all these apparently full grown:—

| | *B. Canadensis.* | *B. leucolæma.* | *B. Hutchinsii?* |
|---|---|---|---|
| | Inches. | Inches. | Inches. |
| Length of bird, from tip of bill to end of tail feathers, measured along the back, | 39½ | 40 | 32 |
| Length of upper mandible, from tip to where the downy plumage begins, measured along the middle, . . | 2 | 2½ | 1¾ |
| Breadth of upper mandible across the nostrils, . . . . . | 1¼ | 1½ | 1¼ |
| Height of upper mandible at the nostrils, . . . . . | ½ | ½ | ½ |
| Length of head, from base of the middle of the mandibles to the occiput, . | 3¼ | 3⅜ | 2½ |
| Length of wing, from carpal joint to end of longest wing feathers, . . | 19¾ | 19¼ | 15½ |
| Length of tarsus, . . . . | 3½ | 3 | 3 |
| Length of first phalanx of middle toe, . | 1¼ | 1½ | 1¼ |

There is also a slight difference in the arrangement of the scuta on the phalanges of the Canada goose and *leucolæma*, though not very decided. In the next species this is much more marked.

*B. Hutchinsii?* Richard and Swain. (Plate I).—The preceding measurements show that this is a much smaller bird, and it will be observed that the proportions are different. The bill is proportionally much smaller, narrower, and deeper, than in the other two. The colour is much the same as in the Canada goose, but darker and richer on the back, and with a greater shade of fawn on the belly, instead of the lavender colour in the Canada goose, owing to the colour of the terminations of the abdominal feathers. The cravat-patch wants the black flecking which Captain Ord informs me he has found to be a constant character in his specimens of the Canada goose.

There is a marked difference in the mode of arrangement of the scuta on the first phalanx of the middle toe. In the two preceding species there are three oblique transverse scuta at the distal extremity, those further back being broken up into polygonal plates; while in this species there are seven broad transverse plates so placed instead of three; the remainder are also transverse, though narrower. The difference in the arrangement in the different species is shown in the plates. I by no means say with any degree of confidence that my specimen is *B. Hutchinsii.* I have had no opportunity of examining an authentic specimen of that species, the specimens placed by Sir John Richardson in the museum of the Edinburgh University being no longer to be found there; but it answers better to it than any other description, and therefore, although not wholly corresponding to it, I place it under this name, but with a query.

I may add, that before coming to the conclusion that these two species were distinct from the Canada goose, care has been taken to consult every accessible authority. The specimens have been shown to Sir John Richardson, who concurs in the opinion that they are distinct.

The want of some information as to the habits of the birds sent by my correspondents, deprives us of one important aid in determining the species. For instance, Hutchin's goose differs from the true Canada goose in frequenting the seacoast, feeding on mollusca, and having a fishy taste, instead of feeding on herbage in the fresh-water lakes, which is the habit of the Canada goose proper. This specimen was taken at Severn House.

*Anas boschas* (Linn.), (Common Mallard).
Trout Lake Station and Severn House.

have been accidental, or it may have been there for breeding purposes, many sea ducks having recourse to fresh-water lakes for this purpose. A circumstance of greater interest, however, is, that it is not the common eider, but the Kamskatchan species *Somateria V. nigrum*, distinguished by a black mark in the shape of the letter V under the chin, and it is the first time that this species has been recorded as being taken east of the Rocky Mountains. Its occurrence in Great Slave Lake certainly does not necessarily imply that it is to be found in Hudson's Bay and the east coast, but it may be so, and I would direct the attention of my friends there to it. It is so easily identified by the black V under the chin that if it occurs there I think we may now be certain of ascertaining the fact.

*Harelda glacialis*, (Linn.)
Severn House.
*Fuligula affinis* (Eyt., Yarr.), (Amer. Scaup Duck).
Severn House.
*Clangula albeola* (Linn.), (Buffel-headed Garrot).
Severn House, Moose Factory, Trout Lake Station.
*Querquedula Americana*, (Linn.)
Hudson's Bay.

This is the American representative of our common teal. Sir J. Richardson remarks that the only difference he could find between the common teal and its American representative was, that the English bird has a white longitudinal band on the scapulars which the other wants. The American bird has usually a transverse broad white bar not possessed by the English. He makes the two species only varieties, but other authors have followed Pennant, and rightly (as it appears to me) kept them distinct. The female specimen sent me, howver, wants the transverse white bar, and Sir John refers to a specimen (he does not say whether male or female) in the Hudson's Bay Company's Museum which wants it.

*Dendronessa sponsa* (Linn.), (Summer Duck).
Hudson's Bay, Moose Factory, Trout Lake Station.
*Oidemia perspicillata* (Flem.), (Surf Scoter).
Hudson's Bay.
*Oidemia velvetina* (Cassin), (*Deglandii*, Bonap.).
Trout Lake Station, Moose Factory, Severn House.

Until put right by Sir Wm. Jardine, I confounded the single specimen received of this species with the *Oidemia fusca*, or velvet scoter of Britain and Europe, to which it is very closely allied—the specific differences consisting in the proportions of the bill, the form of the tuberosity on it, and in the white spot under the eye being larger, and extending in a narrow circle partially round the eyelids. Sir William suggests that both the American and European bird may range in each continent, and that we may find the American form here, or if not, that it is just one of those very close forms which requires farther examination to enable us to say whether it is an extent of variation only, or really a distinct species.

*Oidemia Americana* (Linn.); Trout Lake.
*Mergus serrator* (Linn.); Trout Lake, Severn House.
*Mergus cucullatus* (Linn.); Hudson's Bay, Trout Lake.
*Pelecanus erythrorhynchus* (Gmel.); Hudson's Bay.
*Larus zonorhynchus* (Rich. and Sw.) (?); Hudson's Bay.

Sir Wm. Jardine remarks that in any specimens or figures of the *L. zonorhynchus* which he has seen, the black mark on the bill is at some distance from the tip, which is not the case in this specimen. It does not agree with any other, therefore, most probably, is a variety of this species.

*Larus argentatus* (Gmel.); Severn House.
*Lestris cephus*, Brunnich 1764 (*Buffonii*, Yarr.); Moose Factory.
*Xema Bonapartii* (Rich. and Sw.); Severn House.

## II. *Observations on some of the Birds received from the Hudson's Bay Company's Territories.* By Sir WILLIAM JARDINE, Bart.

Sir William Jardine, in remarking on the species of grouse in the collection, observed that there were two species to which the name of *obscurus* had been applied. The true dusky grouse was first noticed by Mr Say in Major Long's expedition to the Rocky Mountains, and was named by him as a new species, *Tetrao obscurus*, at the same time describing it "with a rounded tail, having a broad terminal cinereous band." It has an extensive range, and extends to California, the specimen on the table having been obtained by Mr Hepburn in the vicinity of San Francisco. In the beautiful ornithological volume of the Northern Zoology by Sir John Richardson and Mr Swainson, there is a bird excellently represented (Plate 59) under the same name, but which is quite distinct from the San Francisco specimens.

Some of our members will recollect that a collector was sent out some years since on an expedition across the Rocky Mountains to Oregon for the purpose of collecting the seeds of hardy trees and plants. This is now generally known as the "Oregon Expedition." I bargained that if any birds were procured they should be sent to me, and among other interesting birds Jeffreys sent a specimen of a grouse exactly corresponding with Swainson's figure above quoted., It is altogether a distinct and darker-coloured bird, and is at once distinguished by its broad tail, square at the end and entirely black, without any terminal cinereous band; the feathers individually broaden towards the tips, and give it a more than usual broad and ample appearance. It was found in the vicinity of Jasper's House, lat. 53° 20′. It does not agree with any of the birds described by the late David Douglass, procured in his excursion across the Rocky Mountains, and I cannot find the specimen from which Mr Swainson drew his figure; but being quite distinct from the *T. obscurus* of Say, I have applied the specific name of *melanurus*.

In regard to the northern gulls, it was remarked that there were two birds supposed to be confounded under the common name of *Larus eburneus*, or *Ivory Gull*, and it is uncertain to which of these the few specimens recorded as killed in Great Britain belong. These gulls are very closely allied, and yet require careful comparison. The one is *Pagophila eburnea* (Phipps), Voyage to North Pole, 1773; the other *Pagophila brachytarsus* (Holböll), in Bruch's Paper, Cab. Journ. fur Ornith., 1853, p. 287. The latter is distinguished by its smaller size, greater comparative length of wing, short tarsi, and darker bill, tipped with bronze. My principal reason for alluding to these is, that a beautiful specimen of the latter form was shot a few years since in Caithness by Mr Shearer, and is now in my possession (*vide* Proceedings of Royal Physical Society, vol. i. p. 4). At the time I considered it as the old *P. eburnea*, but I find it now belonging to the long-winged form, and as such the first recorded in this country.

The thanks of the Society were voted to Sir William Jardine for his valuable communication.

### III. *Notices of the Hen Pheasant assuming Male Plumage, with an Exhibition of the Diseased Ovaries.* (Various Specimens were exhibited.)

By JOHN ALEX. SMITH, M.D.

The bird, with the preparation of its diseased ovaries, which I shall first notice, were brought for exhibition from the Anatomical Museum of the University. It was presented to the Museum by Captain J. W. P. Orde of Kilmory, Argyllshire, in which neighbourhood it was shot, and displayed the characters of the male, especially in the plumage of the head

[illegible]

but the legs were slender, and, as in all the other instances, wanted the spurs of the male. This bird, however, had the peculiarity of its ovaries being perfectly healthy, showing as they did numerous ova; the mass developed were as large as barley, and a few nearly the size of peas. The other viscera appeared healthy. The bird belonged to the Bohemian or light-coloured variety of the pheasant. It would be of some interest, for the sake of comparison, that the period of the year should be stated when birds of this kind are examined; this one, from Peeblesshire (owing to the peculiarity of its plumage), was shot in the beginning of April. A very fine specimen of the true *Phasianus torquatus*, Tem., was also exhibited; it is the Chinese original, with the *Phasianus colchicus*, of our common ring-necked varieties, and is seldom seen in so pure and distinctive a state of plumage. The bird was the property of Mr W. H. May, Muirkirk, in which neighbourhood I believe it was killed.

Captain Orde stated he had examined other specimens of these so-called mule-birds; in one he found the ovaries enlarged by a tumour or abscess,—another diseased state.

## IV. *Observations on British Zoophytes.* (1.) *Coryne implexa* (Alder). (2.) *Coryne* (*margarica, mihi*) *implexa* (Alder). (3.) *Bimeria vestita* (4.) *Garveia nutans.* By T. Strethill Wright, M.D., &c.

*Descriptions of Plates.*

Plate III.

Fig. 4. *Bimeria vestita*; *a*, single tentacle, the clothed portion studded with parasitic Algæ.
5. *Garveia nutans.*
6. *Coryne implexa.* 7. Thread-cells of do.

Plate IV.

Fig. 1. *Goodsirea mirabilis.* 2. Thread-cells of do.
3. Marginal tubercle, with its two tentacles.
4. Young of Cydippe.
5. *Eudendrium arbuscula*, stalked cluster of double spermatic sacs.
6. Section of double spermatic sac—*a*, tubercle containing, *c*, barbed thread-cells.
7. *Peuchastes glacialis.*

### 1. *Coryne implexa* (Alder).

Under the title of *Tubularia implexa*, my friend Mr Alder has described a zoophyte discovered by Mr R. Howse in 40 fathoms water, 30 miles from Holy Island. Mr Alder's description of it is as follows:—“ *Tubularia implexa*.—Tubes small, very slender, generally more or less contorted below, smooth, wrinkled or regularly annulated beneath a smooth transparent epidermis; slightly and subunilaterally branched; the branches going off nearly at right angles to the stem, and a little constricted at their base; gregarious, forming a densely-tangled mass of half to three-quarters of an inch in height.

The polyp of this zoophyte had not been observed, for which reason Mr Alder considered that its claim to a place in the genus Tubularia could not be fixed very decidedly. Its most remarkable feature is the structure of the corallum or polypidom, which is divided into two coats, as in Plate III., fig. 6; a structure hitherto observed only in one other species, the *Campanularia caliculata* of Hincks. Mr Alder kindly sent me a specimen of his *Tubularia implexa*, which, after a careful examination I concluded to be, not a Tubularia, but a Coryne; and I wrote to Mr Alder to that effect. Fortunately, although the specimen was destitute of polyps, portions of the polypary or cœnosarc still remained, and I found in its tissues two kinds of thread-cells, the one oval, and containing a barbed dart (fig. 7, *a*), the other cylindrical, with almost truncated extremities, in which the thread was not conspicuous. (*b*), The first of these resembled very closely the oval, barbed thread-cells of *Coryne decipiens;* while the second, although much larger, evidently corresponded to the long, slender thread-cells found on the body

In September last, I found on Inch Garvie the beautiful large Coryne which I place on the table this evening; one of the polyps being shown at Plate III., fig. 6.

### 2. *Coryne (margarica, mihi) implexa* (Alder).

Corallum branched or creeping; composed of two coats, the inner coat horny, annulated at intervals; the outer coat membranous, smooth, longitudinally folded near the polyps. Body of the polyp cylindrical, much elongated; summit truncated, very transparent, of a pearly white colour; mouth surrounded by a dense white ring. Tentacles small and slender, very numerous. Thread-cells on tentacles oval, barbed; on the body of polyp, long, cylindrical. Both kinds of thread-cells within the corallum.

This zoophyte, as to its polypary, bears a close resemblance to the *Tubularia implexa* of Alder, and I have little doubt is identical with it; in which case *Tubularia implexa* is, as I suspected, a Coryne. It has the same double structure in the tube of the corallum, and the thread-cells, both in form and size, are identical. The polyp of the species is distinguished from all others of its genus which have come under my notice by the extreme transparency of its tissues, and the small size of its tentacles; in which last particular it resembles the *Coryne pelagica* of Alder, and even approaches *Myriothela artica.* The thread-cells on the tip of the capitate tentacle are of very small size, as in Myriothela, with the exception of one, or sometimes two, of the large cells which are found in the same situation in other species of Coryne.

### 3. *Bimeria vestita.* (Plate II., fig. 4.)

Polypary minute, very slender, branched, smooth, or wrinkled near the division of the branches, enclosed in a transparent horny corallum; polyps vase-shaped, destitute of proboscis; tentacles slender, alternate, as in Eudendrium; corallum, body, mouth, and lower half of each of tentacles of polyp clothed in an opaque brown membrane; thread-cells inconspicuous.

This remarkable zoophyte first occurred to me on the Bimer Rock, near North Queensferry, in August last, and afterwards to Dr M'Bain and myself on Inch Garvie. It differs from all zoophytes hitherto described in being completely clothed—as the corallum, the bodies of its polyps, and part of their tentacles—in a thick, soft membrane, which appears to be formed of the glutinous "colletoderm" thickened by fine mud. The tentacles were frequently united together in pairs by the same substance. The unclothed half only of the tentacles was furnished with thread-cells. The bodies and clothed part of the tentacles were frequently studded with minute crimson Algæ (fig. 4, *a*), which in some cases almost concealed the polyps, but did not seem to exercise any deleterious influence on their health.

The male reproductive apparatus consisted of an ovate pedicled ectodermal sac (fig. 4, *b*), inclosing a linear unbranched process of the endoderm, as in Hydractinia, the whole enclosed by the horny corallum with its muddy covering. The female reproductive system was not discovered.

### 4. *Garveia nutans.* (Plate III., fig. 5.)

Polypary enclosed in smooth or slightly-wrinkled corallum, creeping or forming a stem of many agglutinated tubes from which the polyp stems diverge as branches; polyps not retractile within the corallum, decumbent when contracted; tentacles about ten, thick, in a single row, not alternate; mouth not trumpet-shaped; colour of polyp vermilion and yellow; thread-cells inconspicuous.

This zoophyte, which occurs on Inch Garvie, is conspicuous for the singular colour of its polyps; the ectoderm being of a fine transparent yellow, the endoderm vermilion. Consequently the tentacles are yellow, while the body of the polyp is red. When irritated, as by being removed from the water [redacted] posed in two rows. In Eudendrium the body of the polyp is studded by very large thread-cells; in Garveia these thread-cells are absent.

### V. *On some Peculiar Forms of Spines on two Species of Star-Fishes* (Gen. Ophiocoma). (Drawings were exhibited.) By Charles W. Peach, Esq., Wick.

During my residence at Peterhead, I met with a very delicate Ophiocoma,—probably *O. neglecta*,—which I was very desirous of naming. For this purpose I placed it alive in sea-water under the microscope, and found that one of the spines had a notch of some width running down the whole length of it; this, I thought, had been caused by accident. On farther examination, I found that each lower spine had a similar opening;—the edges of the openings serrated, the whole covered with short pointed protuberances. I also saw the pinnated cirrhus protruded, as at A, fig. 1, of the sketch exhibited. Not finding this notch mentioned by Forbes, or any other writer on star-fishes, I have been led to examine others, and have been rewarded by finding on the brittle star, *Ophiocoma rosula* of Forbes, in addition to the "beautiful long tapering rough spine," which, he said, "might serve as a model for the spire of a cathedral," on the under side of each row *a jaw-like hooked one* furnished with teeth (sketch No. 2); they are transparent, and formed of the same material as the other spines. These jaw-like spines extend the whole length of the rays, and are arranged (as at fig. 2, where the tip and two of the under sides of the ray-plates are represented) with the spines and cirrhi. Two of the straight spines of each group have also hooks on their tips, directed, as are the teeth of the jaw-like ones, towards the disk. No. 3 is a side-view of a jaw-like spine. I have seen these jaw-like spines on specimens *in all stages of growth*, some not one-fourth of an inch over. There are many other things as well as these spines that I might call your attention to, would time permit. When describing *Ophiocoma Goodsiri*, Forbes mentions "difficulties connected with the tracing of the connection between species and species;" and though he found in *O. Goodsiri* "a beautiful link between the scaly and plated brittle stars," he farther says, "Before I saw this species, I had some doubts as to the propriety of retaining these two variations of character in the one genus, and suspected that *Ophiocoma rosula* might be the type of a separate group." Had he seen these jaw-like spines, he would, I think, have separated it, especially as at page 20 he farther says,—"the sources of specific character are derived from the spines of the body and arms." In his work, the only hooked spines mentioned are those found on *Comatula rosacea*, and the pick-like one on *Ophiocoma filiformis*. Dr Carpenter, in his work, "The Microscope and its Revelations," at page 559, gives a sketch of the hooked spine of the Euryale; and now, in all probability, the true connection between it and *Ophiocoma rosula* will be better seen. These observations were made on specimens found at Peterhead and Wick, N.B. I have since had *Ophiocoma rosula* from Mr King of Torquay, Devonshire. Dr Dickie of Belfast has also kindly sent me it from Ireland. *All show* the hooked spine, and other characters, as those from Scotland. Dr Dickie added to his kindness by forwarding part of an arm, marked *Ophiocoma minuta*, by the late Mr Thompson, and which formed part of that lamented gentleman's collection, and on this I find similar hooked spines of both sorts; and if this *O. minuta* is a good species, I have several specimens from Peterhead and Wick, and thus have another addition to our list. Should *Ophiocoma rosula* be found without these jaw-like spines, the one now described will be, if nothing else, a new species. The following reasons have induced me to lay these imperfect observations before you—*First*, to ask those who have time and opportunity, and are placed in good localities, to work out the history of these spinigrade animals; for we want, in addition to the beautiful figures given by the lamented Forbes, each species figured with dissected sections of spines, body, and ray plates, &c. These new characters may lead to other discoveries, and a standard be arrived at by which genera and species may be satisfactorily made out much better than at present. *Second*, When I had the pleasure of accompanying Sir Roderick Murchison, the past summer, on his geological tour, he told me that some one had figured and described certain minute fossils found in Silurian rocks as jaws of animals, and which he (Sir Roderick) thought were portions of star-fishes. I sketched one of the jaw-like forms I had met with in *Ophiocoma rosula*—this, he thought, resembled in some measure the supposed jaws taken from the Silurian rocks. Should this be the case, by giving publicity to this discovery I hope to do good both to Zoology and Geology.

### VI. *Notice of the* UKPAM, *a large species (probably new) of Sting Ray* (Trygon, Cuv.), *found in the Old Calabar River, Africa.* (Two young specimens were exhibited.) By JOHN ALEXANDER SMITH, M.D.

The Ukpam is the native African name of a species of Ray which is found in the rivers of Old Calabar, on the west coast of tropical Africa. This fish appears to grow to a great size.

Umon, which are about 150 miles from the bar, and where, although the river still rises and falls with the tide, from there being always a strong downward current, the water is perfectly fresh, and never even brackish. The two young specimens now on the table were sent home some time since by Mr Archibald Hewan, surgeon to the Old Calabar Mission of the United Presbyterian Church, to the members of which mission the Society has been again and again indebted for various interesting additions to the knowledge of the zoology of Western Africa. The natives have a curious theory that these young fish, somewhat after the manner of the young of the marsupial animals, take shelter in the maternal organs, which they leave or enter at pleasure, until they are old enough and strong enough to take care of their personal safety. Mr Hewan, however, says that one of the natives, who prides himself on his skill in capturing this rather formidable creature, denies this statement altogether; so that, probably the pain of being struck through with a spear at its capture, causing in some instances the expulsion of the nearly mature young, may have given rise to this idea (should it turn out to be false); which, however, is generally believed among the natives. Mr Hewan has promised to give some attention to the subject, so that we may hope to be favoured with more information before long.

The specimens exhibited, Mr Hewan says, are very young. He was asked to go down to the river side, where a native had in his canoe a large male and female *Ukpam* he had just captured. These fishes measured about 4 feet across; and while Mr Hewan was standing near the canoe, " the native was searching the body of the female, because he did not see the young ones (the specimens now exhibited) in the canoe where he had left them. He had not searched the canoe thoroughly, and so, not finding them in the oviduct, he repeated his search in the canoe, and there they were lying. His searching the body was strong presumptive evidence that he had found them there before; but that they returned there seems only a theory, unless the native's word be taken." Mr Hewan states these fish were alive and active when he got them; and, as far as we can judge by their appearance, they must both have been but recently ushered into the world. If the latter theory is correct, the Trygon would appear therefore to be viviparous, its young being hatched in the oviduct prior to exclusion—and to have two young ones, or, at least, the birth of one young one must very rapidly succeed the other; as I am unable to detect any difference of age, except in the rather greater size and bulk of one of the specimens, which, however, appear to resemble one another very closely in all respects.

These young specimens of the Trygon are of a uniformly rounded outline, rather longer than broad, and diminish a little in breadth, towards the long whip-like tail; one measures from the slightly projecting snout to the extremity of the tail 40½ inches; the other is about one inch shorter; the body of the larger one measures 11½ inches to the extremity of the inner lobe of the ventral fins. The tail itself is 30 inches in length. The fish is about 10¼ inches in its greatest breadth a little in front of the middle, the smaller one measuring about 10 inches; the pectoral fins surround the head, and are produced in front in the mesial line about ⅓ of an inch: from this point, to the large and very prominent eyes, it measures 2½ inches; and the eyes are 2 inches apart. The upper eyelid has a rounded adnate projection There is a large round-shaped fossa on each side, immediately behind and below the eyes, of an inch in length by about an inch in breadth, across the back part of which are the large temporal openings and form, probably, the claspers of the male fish; the two fins are connected together by a frenum behind the anal openings. The rounded posterior edge of the ventral fin measures about $2\frac{1}{2}$ inches across, and the root of the fin 1 inch across.

There is a general rough, granular appearance over the upper surface of the body, which is now of a muddy yellowish brown colour, and this granular appearance diminishes towards the sides as you approach the pectoral fins, which are smooth above. The granules are larger and more distinct, and become circular in shape, as you approach the mesial line of the fish, which from the posterior half of the body gives indications of larger circular plates or shields, these become still larger as you approach the base of the tail, and cease in the mesial line a little beyond it, within an inch or so from the insertion of the spine. Beyond this, again, a smaller double range of oval-shaped obliquely-placed bony scales or granules can be traced for a considerable distance along the sides of the slender tail; an indication, apparently, that as the fish increases in size with age, there will be a greatly increased development of these bony spines and shields on the back and tail. About $3\frac{3}{4}$ inches from the insertion of the tail you find a firm bony moveable spine inserted into the middle line of its upper surface, corresponding to the barbed spine of the sting Rays; it is about an inch in length, and is $\frac{2}{10}$ths of an inch in breadth, but has no barbs on its sides, being smooth and edged with membrane, and terminates in a rounded and flattened button-like extremity, rather more than $\frac{1}{8}$ of an inch in length. The sword in this instance is covered by a scabbard; what change age may make on it I am of course unable at present to say. Mr Hewan has promised to send the tails and jaws of adult individuals of both sexes for examination; so that I hope to be able at another opportunity to enter more fully into a description of its adult characters.

The under surface of the fish is lighter in colour and smooth; the slightly arched mouth is about $2\frac{1}{2}$ inches from the extremity of the snout, and measures $\frac{9}{10}$ths of an inch in width; its jaws are covered with alternate rows of small rounded or oval-shaped teeth with transverse markings, closely set together. Behind the teeth of the upper jaw there is a deep fringed velum, and a shallower smooth-edged velum lies behind the teeth of the lower jaw, five small warty-like papillæ projecting behind it into the mouth. In front of the mouth you have the free transverse slightly-fringed margin of the undivided nasal membrane, with its frenum in the mesian line, attaching it to the upper jaw; it is also free at its outer margins (leaving an obliquely placed nasal opening on each side), and thus forms altogether a double flap, which covers the large transversely placed nasal organs. About 1¼ inch behind the mouth, the double row of spiracles or gill openings, five in number on each side, run backwards in a curved direction; and about ½ an inch behind them, but in the mesial line, at the forepart of the abdomen, you find a small projecting body which measures $\frac{8}{10}$ths of an inch in length by $\frac{1}{8}$th of an inch in breadth; it is $3\frac{8}{10}$ths inches distant from the mouth, and from it to the anal opening measures 4 inches; it appears to be the last remains of the now all but absorbed vitellus or yolk of the egg, the umbilical bag which nourished the fish in its younger stage of existence. The whole length of the fish along its under surface is, from the snout to the middle of the anal opening, 10 inches, and from the anal opening to the extremity of its slender and pointed tail 30 inches.

The tail is rounded above; it measures about an inch in breadth at its insertion to the body, and tapers to a minute point. Nearly opposite the insertion of the spine above, there begins on the under surface a narrow fin without rays, which projects about one-tenth of an inch, and runs with a low and

and not merely distinctive of an immature fish, it seems to occupy a middle position between the GENUS *Urogymnus* of Gray—"Tail without a spine;" and the GENUS *Trygon*—"Tail with one or more serrated spines;" as having "Tail with spine bordered and tipped with membrane;" otherwise I am inclined to place this fish under the GENUS *Hemitrygon* of Müller and Henle, which is distinguished by having a "tail with a hem-like fin on the under side only." In the British Museum Catalogue of 1851 there are only two species given under this genus, one from the Chinese Seas, and the other from the Adriatic; so that this large species may possibly not have been previously described; and I would accordingly, while waiting for more information on the subject, give it the provisional name of *Hemitrygon Ukpam.* I have presented one of the specimens of this fish to the Natural History Museum of the University.

Sir William Jardine said, the account given by the natives of the young fish entering the maternal organs was very interesting; the RAYS were considered the analogues of the MARSUPIATA among animals, and it would be very curious indeed should a peculiarity of this kind be common to both. The thanks of the Society were voted to Mr Archibald Hewan, Old Calabar, for his kindness in forwarding to this country the specimens of the *Ukpam.*

### (2.) *Notice of the* Passer montanus, *the Tree Sparrow, shot near Dunbar.*

By JOHN ALEXANDER SMITH, M.D.

The *Passer montanus*, the Tree Sparrow (exhibited), was shot at Pitcox, near Dunbar, by Dr C. Nelson, and was the first specimen he had seen killed in Scotland. It is distinguished from the common sparrow by its smaller size, by the chestnut colour of the top of the head, which is also more divided from the colours of the back, by the sides of the neck being white, by a distinctly-defined black spot on each cheek, and by two white stripes on the wing, there being only one in the common sparrow. Our books on ornithology state generally that this bird has never been observed in Scotland. From its considerable resemblance, however, to the common sparrow, it might be easily overlooked. Mr Keddie, assistant to Mr Sanderson of George Street, informed me he had seen specimens of this bird, some five or six years ago, frequenting

entire skull from near Athol,
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The following communications were read :—

## I. *On some Fossil Bovine remains found in Britain.* By Wm. T[illegible], M.B., London; Demonstrator of Anatomy, University of Edin[illegible]

The Fossil remains which I am about to bring before the notice of the Society this evening belong to the Bovine Family of the order Ruminantia. They have been collected from various localities, and have been placed at my disposal for purposes of description by several friends to whose care their preservation is due, and to whom I must confess my acknowledgments for permission to make use of them on this occasion.

The largest and most characteristic of these Fossil Bones are from the Anatomical Museum of the University of Edinburgh, where they have formed a part of the osseus collection for upwards of forty years. No description of them has ever been put on record. I have, through the kindness of Professor Goodsir, an opportunity of describing them to the Society this evening. These bones consist of two crania, a femur, scapula, humerus, the second cervical vertebræ, a rib, and the left horn-ore with a small portion of the frontal bone. Unfortunately o account either of the locality in which they were obtained, r of the deposit in which they were found lying, has been reserved; and, from the length of time which has clapsed ince they were discovered, it is almost hopeless to expect that ny accurate information respecting these important and inte-sting particulars will ever be obtained. If one might form a opinion, however, respecting the nature of the deposit in hich they had been imbedded, by the deep brown colour of several large Scots firs near Mitchells, a hamlet not far from Leuchars, in Fife. The following extract from Dr Nelson's letter gives some interesting details:—

"The first time I saw this species alive was in Lancashire, about 10 years ago, when waiting for hawks, &c., at dusk, in a small plantation more than a mile from any house. For several nights I had observed eight or ten birds take up their abode under an old magpie's nest, and their call being something new to me, I sent some dust-shot at the nest, and down came three of this lively little finch—the first I had ever seen in the flesh. I saw nothing more of the species till about four years ago, when I killed a pair at my brother's at Castleton, near to Tantallon Castle. I expected to find them nesting in the ivy which " braves the blast" on several points of that old ruin; but although I looked anxiously for them dozens of times, I never saw any but the common species. The specimen sent I killed with an air-cane about two months since. A colony of about a dozen has taken up their habitat in a wood about a hundred yards from my house, and for many weeks have come to feed under my windows, in company with the chaffinch and greenfinch. While I am writing this, my little favourites are within four yards of the window; and I can count as many as five—all males—one evidently an old cock, from his bright plumage. In and about my farm steading, which is not far from the house, the common species, *Passer domesticus*, is in hundreds; but I have never once seen *P. montanus* mixing with them. It would seem that he looked upon his plebeian brother with contempt, preferring the company of the bright liveried spink and the spring-tinted chloris. The food seems to be the seeds of several of our common weeds, and they will battle, and successfully, too, with the more robust greenfinch, should he trespass on their feeding-ground."

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*Wednesday, February* 23, 1859 —ANDREW MURRAY, Esq., President, in the Chair.

The following Donations to the Library were laid on the table:—

1. Ruminantia (from the Cyclopædia of Anatomy and Physiology.) By T. Spencer Cobbold, M.D. 2. Observations on Entozoa, with notices

of several new species. &c. By T. Spencer Cobbold, M.D.—From the Author. 1. Physikalske Meddelelser af Dr Christopher Hansteen. Christiania, 1858. 2. Inversio Vesicæ Urinariæ og Luxationes femorum congenitæ. Af Lektor Voss. Christiania, 1857. 3. Forhandlinger ved de Skandinaviske Naturforskeres, Christiania. 2 vols. 1847-1857.—From the Royal University of Christiania. Proceedings of the Literary and Philosophical Society of Liverpool, No. 12., 1857-1858.—From the Society. The Canadian Journal of Industry, Science, and Art, new series. No. 18. November 1858.—From the Canadian Institute, Toronto. Transactions of the Botanical Society, vol. vi., part i., 1857-1858 —From the Botanical Society, Edinburgh.

The following communications were read :—

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The Fossil remains which I am about to bring before the notice of the Society this evening belong to the Bovine Family of the order Ruminantia. They have been collected from various localities, and have been placed at my disposal for purposes of description by several friends to whose care their preservation is due, and to whom I must confess my acknowledgments for permission to make use of them on this occasion.

The largest and most characteristic of these Fossil Bones are from the Anatomical Museum of the University of Edinburgh, where they have formed a part of the osseus collection for upwards of forty years. No description of them has ever been put on record. I have, through the kindness of Professor Goodsir, an opportunity of describing them to the Society this evening. These bones consist of two crania, a femur, scapula, humerus, the second cervical vertebræ, a rib, and the left horn-core with a small portion of the frontal bone. Unfortunately no account either of the locality in which they were obtained, or of the deposit in which they were found lying, has been preserved; and, from the length of time which has elapsed since they were discovered, it is almost hopeless to expect that any accurate information respecting these important and interesting particulars will ever be obtained. If one might form an opinion, however, respecting the nature of the deposit in which they had been imbedded, by the deep brown colour of the outer surface of all these bones, with the exception of the larger cranium, one would be led to suppose that they had reposed for a lengthened series of years either in close contact with a peaty soil, or in water deeply impregnated with organic matter.

The two crania present all the characters which belong to that great fossil ox which has been described by Bojanus and Owen by the name of *Bos primigenius*. These are especially the great length and peculiar curvature of the horn-cores, their origin, from the extremities of the ridge which separates the frontal from the occipital portions of the cranium, and the slightly concave forehead with which the plane of the occiput forms an acute angle; characters which were first specifically laid down by Cuvier,* and which enable the anatomist to distinguish the cranium of the Bos from that of the Aurochs, with which, at the first glance, it might be confounded. Both the crania have evidently belonged to fully formed animals, probably, indeed, advanced in years; for the sutures are almost without exception obliterated by ossification, and the two last posterior molars which remain on the left side of the upper maxilla of the best preserved skull are very much worn. These are the only teeth which have been preserved; portions of the fangs of one of the other molars are still present, however, in their sockets. In this skull, all the bones of the cranium, as well as those of the face, with the exception of the lower jaw, are in an almost perfect condition. The other magnificient specimen of an entire skull from near Athol, Perthshire, now in the British Museum."*

| | British Museum.<br>Inches. | E. U. Museum.<br>Inches. |
|---|---|---|
| Length of Skull, . . . | 36 | 26 |
| Breadth of Forehead between horns, . | 10½ | 9½ |
| Breadth of Occipital Condyles, . | 6 | 6 |
| Length of series of Upper Molar Teeth, | 6½ | 6½ |

Whilst the skulls agree pretty closely in several of their measurements, there appears to be a considerable difference between them as regards their length. Professor Owen does not state what were the extreme points between which he measured. In the most perfect of the two crania in the Edinburgh University Museum, the length of which is above given, the line was drawn from the frontal ridge between the horn-cores to the tip of the intermaxillary bone. If the line be extended backwards, however, as far as the occipital foramen, the measurement is increased to 33½ inches. The span between the tips of the horn-cores is thirty inches, and the circumference of the cores at the base 15 inches; between the orbits the skull measures 12 inches.

If, as may very reasonably be conjectured, these crania were found in Scotland, they add another to the many previously existing examples of the existence of this large Bos in this country. In addition to the instance already quoted from Professor Owen's work, Dr Fleming† has recorded instances of the existence of large bovine crania in the marl-pits of Scotland, "exhibiting dimensions superior to those of the largest domesticated breed." These, however, he refers to the *Bos taurus*. I have had an opportunity of seeing the cranium particularly referred to by Dr Fleming. It is a remarkably fine example of the *Bos primigenius*, the teeth, especially, being well preserved. It is now in the Museum of the Free Church College. In the Museum of the College of Surgeons in this city is a well-marked specimen of the cranium of this animal. In the Museum of the Society of Antiquaries there are three crania, two of which are in very good condition, they were obtained in the southern counties of Scotland. Dr J. A. Smith informs me that about forty years ago many crania were discovered in these counties by the diggers for marl.

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* Owen—"History of British Fossil Mammals and Birds," p. 501.

† History of British Animals, p. 24.

Mr Parkinson also, in his " Organic Remains,"* states that he has in his possession specimens of Bovine Fossils obtained in Dumfriesshire. Professor Owen is of opinion that the *Bos primigenius* " maintained its ground longest in Scotland before its final extinction." This opinion is founded on the very recent character of the osseous substanee.

It is probable that the femur, scapula, humerus, rib, and vertebra, were found in the same deposit, and along with the least perfect of the above-described crania; for they present in their deep brown colour corresponding appearances externally. If such is the case, we shall be justified in regarding them as bones belonging to the *Bos primigenius*. On contrasting them with the corresponding bones of the modern Bos inhabiting this country, I find that they present the same anatomical characters, only on a much larger scale, on account of their greater size, This is seen especially in the spines, trochanters, tuberosities, and other ridges and prominences for the attachment of muscles and ligaments, which are all developed in an exaggerated form, and indicate most prominently what the great muscular development of the animal must have been. These bones are all in an admirable state of preservation, the osseous characters being distinctly marked, and the various articular surfaces smooth, and pre-

| | Fossil.<br>Inches. | Existing.<br>Inches. |
|---|---|---|
| *Right Femur.* | | |
| Extreme length, . . . | 20¾ | 17 |
| Circumference of middle of shaft, . | 7¼ | 5¾ |
| Diameter across condyles posteriorly, | 6 | 4¾ |
| Greatest diameter of upper end of bone, | 7 | 6 |
| *Left Scapula.* | | |
| Extreme length, . . . | 19 | 15¼ |
| Extreme breadth, . . . | 10¼ | 9¼ |
| Length of spine, . . . | 15 | 13 |
| Longest diameter of glenoid fossa, . | 3¼ | 2¾ |
| *Right Humerus.* | | |
| Extreme length, . . . | 17½ | 13 |

| *Right Humerus.* | Fossil.<br>Inches. | Existing.<br>Inches. |
|---|---|---|
| Circumference of middle of shaft, . | 9 | 7 |
| Breadth across condyles, . . | 4¼ | 3½ |
| Greatest diameter of articular surface of head, | 5 | 4 |

The rib is most probably the seventh on the right side. Its length is 28 inches, and its greatest breadth 2½ inches.

The vertebra is the second cervical or axis.

| | Inches. |
|---|---|
| Extreme height, . . . | 8 |
| Extreme antero-posterior diameter, . | 7 |
| Circumference of anterior articular surface, | 14 |

The bulky nature of the spine and other processes of this vertebra point to the great size of the head of the animal to which it belonged, and indicate a corresponding development of the muscles and ligamentous structures which must have been connected to it.

From some further measurements that I have made, I have endeavoured to arrive at some estimate of the size of the entire skeleton of this great extinct Bos; this has been done by comparing the length of certain of the bones of the common ox with the height of that animal's skeleton, and then contrasting them with corresponding bones of the fossil animal now before us; this comparison has led me to the conclusion, that the skeleton of the extinct animal must have stood nearly six feet in height at the shoulder. If we now imagine this skeleton clothed with a thick coating of powerful muscles and hairy integument, having appended to the anterior extremity of the spine an enormous head with a pair of large and widely curving horns, we may form some idea of the formidable appearance that this extinct animal must have presented when, in the full vigour of its existence, it roamed unfettered through its native forests.

The other fossil remains, of which I have specimens, were found at different periods in the north-western division of the county of Lancaster. They were not obtained in the same locality, but at places several miles apart from each other; some being found in the district of Pilling, in the immediate neighbourhood of the mouth of the river Wyre, others close to the town of Preston. From information with which I have been supplied, I think it probable that the stratum in which they were imbedded was of the same nature, consisting of sand and gravel, lying immediately beneath the peat.

The specimens from Pilling consist of a large vertebra and a tooth. They were transmitted to me by the Rev. J. D. Banister, the incumbent of that district, a gentleman who, for a long series of years, has paid great attention to the natural history of the locality, and who carefully preserves any object of interest which may fall in his path. I have been favoured by Mr Banister with the following particulars of the deposit in which they were found:—"Pilling Moss is an extensive post-tertiary fresh-water deposit, situated between the mouths of the rivers Wyre and Cocker. It forms the present coast-line between these rivers, and is bounded on the land side by an ancient sea-beach, distant, on an average, two miles from were found. In different parts of the same layer numerous bones, horns, and teeth of the red deer have at various times been discovered."

The vertebra is the fifth cervical, and in its shapes and general anatomical characters, especially the concavo-convex nature of the articular surfaces of the centrum, and the foramina at the roots of the transverse processes, bears a closer resemblance to the cervical vertebræ of the larger members of the order Ruminantia than to those of any other mammalian order.

Thinking, in the first instance, that it might belong to the *Megaceros hibernicus*, I made a close comparison between it and the fifth cervical vertebra of the skeleton of that animal preserved in the Natural History Museum of the University of Edinburgh. It differs, however, in several of its measurements, more especially in the antero-posterior diameter, in which it is considerably shorter. On the whole, it may be said to possess a much more elegant shape than the vertebræ of the Megaceros. In its characters it corresponds much more closely to the fifth cervical vertebra of a bovine animal; and, from its size, it has probably belonged either to the *Bos primigenius*, or to the great fossil Aurochs, *Bison priscus*. In confirmation of this opinion, I have the high authority of Professor Owen, to whom I presented a cast of the vertebra some months ago. It may be interesting to contrast for a moment this vertebra with a human cervical vertebra, when the difference between the relative size of the neural canals and the bony processes is at once apparent, the neural canal of the fossil bone being very little larger than the corresponding canal in the human vertebra, whilst the processes of the former are many times larger than those of the latter. The circumference of the fossil, measuring it around the tips of the processes, is 26½ inches. From the almost perfect state of the bone, it must have reposed quietly in the position in which it was found, and have been subjected there to very slight external influences.

The tooth found in the same stratum, and in the immediate neighbourhood of the vertebra, is the last pre-molar of the right side of the upper jaw of a bovine animal, probably the *Bos primigenius*. It has three fangs. The inner surface of the crown is convex, the outer concave and sinuous, the extremities projecting into considerable points. A crescentic enamel island lies in the centre of the tooth, the concavity of which is turned towards the sinuous outer surface of the crown, the extremities of the crescent project to the pointed extremities of the outer surface. At the first glance, it might appear as if this tooth were too small for the cranium of so large an animal as the great extinct Bos; but it was found, on trial, exactly to fill the empty socket of the corresponding tooth in the large cranium of this species in the University Museum, already described. On referring to the cranium which belonged to Dr Fleming, I found the corresponding pre-molar tooth still in its socket, and presenting exactly the same anatomical characters.

The bones which I have obtained from the neighbourhood of the town of Preston were found in the year 1836, by the workmen employed in digging the foundations for the piers of the railway bridge over the River Ribble. They were preserved by Mr Joseph Thornber, and by him presented to S. B. Worthington, Esq., the engineer to the Lancaster and Carlisle Railway, who deposited them in the Museum of the Lancaster Mechanics' Institution.

Mr Thornber, in a note which he has furnished me with, states that the bones were found in a stratum of gravel and sand beneath the peat. This stratum rested on a bed of new red sandstone. One of these bones is an undoubted relic of base of of the cranium, a portion of a rib, and the left innominate bone. Of these, it is probable that the first-named only has belonged to a bovine animal. This consists of the basilar process, occipital condyles, and the remaining portion of the ring of bone which surrounds the foramen magnum. It is difficult to say with absolute certainty what animal the other bones had formed a part of. The rib scarcely appears to be bovine, for it is thicker and more massive; the ridge upon its outer surface is proportionally much stronger, and there is only a trace of a groove upon its inferior margin.

The innominate bone is much more slender than the pelvic bones of the existing species of Bos. On comparing it with the corresponding innominate bone in the skeleton of the Megaceros in the Natural History Museum, so many points of similarity were found between them, that I felt inclined to pronounce it to be the innominate bone of the great extinct Irish elk; but, on closer inquiry, I learnt that it is very doubtful if many of the bones in that skeleton are genuine bones of the Megaceros, no less an authority than Cuvier, in the fourth volume of the "Ossemens Fossiles," stating, in some critical remarks which he makes upon an engraving and measurements of the skeleton transmitted to him by the late Professor Jameson, "that it is doubtful whether the pelvis is well authenticated, seeing that it is not so altered as the rest of the bones." I find that the innominate bones have been painted dark brown, so as to give them the same colour as the other bones of the skeleton; and on scraping off the paint, a clear white osseous surface is seen beneath.

It is probable that this innominate bone belonged to an animal of the genus Equus, for both in size, shape, and osseous markings, it corresponds most closely with the left pelvic bone of the horse. If this be the case, it adds another to the localities, cited by Professor Owen, in which the remains of this animal have been discovered, and from having been found in the same stratum as, and in the immediate neighbourhood of, the frontal bone of the *Bos primigenius*, it establishes the coexistence of these different genera in our island.

Mr David Page stated instances of the occurrence of the

*Bos primigenius* in the north of Scotland; and Dr J. A. Smith mentioned that its remains had been found in Selkirkshire and Roxburghshire, and referred to notes he had collected some time ago, in regard to the skulls preserved in the Museum of the Society of Antiquaries of Scotland, which he might lay before the Society at another meeting.

### II. *On* Goodsirea mirabilis, *an undescribed Gymnopthalmatous Medusa.*

By T. Strethill Wright, M.D., &c.

Three specimens of this medusa were taken in the Firth, near Queensferry, in September last, one of which the author placed on the table this evening. In general form it resembled the *Plancia gracilis* of Forbes; but it differed from that animal in the shape of its smaller tentacles, the absence of eye-specks, and the presence of auditory organs. The disc was hemispherical, depressed, in some specimens elevated in the centre, and about an inch in diameter. Its margin was furnished with two large colourless tentacles, which were capable of being produced to the length of about two and a-half inches. For about one-third of their length they were hollow, and permeated by the circulating fluid of the lateral canals. The proximal portion of the large tentacles was covered with long, narrow, curved thread-cells, arranged in clusters or cones, like the piled muskets of a regiment of soldiers. These, towards the distal ends, became mixed with large, scattered thread-cells, of an ovate, or rather almond shape, in the intenucleated cells, joined end to end in a single row, which portion terminated in a long ovate head, closely set with the large almond-shaped thread-cells, which were found on the tips of the larger tentacles. All these tubercles and their tentacles were destitute of ocelli. Eight otolitic sacs were attached to the exterior of the circular canal, each containing about four otolites. The sub-umbrella was formed by four lateral canals, with their connecting membrane. Its upper part dipped downward so as to form a funnel, from the end of which the peduncle or alimentary polype was suspended. The peduncle, about an inch and a half in length, was very extensile, and of a greenish white colour. It was terminated by a quadrangular campanulate mouth. The peduncle in the female was rendered quadrangular by the four band-like ovaries, which passed along its whole length, and contained countless eggs. In the male it was cylindrical, and included a mass of spermatozoa between its ectodermal and endodermal layers. The whole of the lateral and circular canals were powdered, as it were, with dark purple pigment granules. When floating in the sea, or jerking itself along by the rapid strokes of its disk, this medusa was only rendered visible by the snake-like motions of its peduncle and tentacles. All the rest of its body was as transparent as glass. In a well-lighted jar of sea-water, the outer surface of the umbrella glowed with tints of blue, purple, and amber, reflected from the thin ectodermal membrane, which covered the gelatinous umbrella. With regard to this gelatinous structure, Dr Wright had come to the conclusion that it was not the homologue of the ectoderm of the polype, but rather a true corallum, homologous with the horny plate of Velella and the corallum of Hydractinia. Did it consist of ectoderm, it would be rendered opaque by alcohol, which was not the case, as might be seen in the specimen on the table. In captivity these animals floated near the bottom of the jar in which they were confined, supporting themselves on their tentacles and peduncle, with which they were constantly searching the bottom, as if for food. One of the females discharged a large number of ova, which were carefully preserved in a proper vivarium, and watched, but no farther development took place in them. Dr Wright had denominated this animal *Goodsirea*, after the distinguished anatomist of that name.

Dr Wright placed on the table specimens of the *Gromia oviformis* of Dujardin, a gigantic Rhizopod, which he had just discovered in his tanks, and which were displaying the long and intricate branching of their pseudopodia extended along the glass.

### III. *Notice of some Birds observed in the Island of Heligoland, in a Letter from W. H. Gätke, Esq.* Communicated by Professor Balfour. (Specimens were exhibited.)

We give the following extract from this communication :—

"I have ventured upon sending a few birds obtained on this island (Heligoland), which probably may prove acceptable to your College Museum. They are a female of a species labelled in the College Museum, if I recollect right, *Sylvia Tytleri*, obtained somewhere in India; it is the *Muscicapa parva* of continental ornithologists, a bird visiting this island almost every autumn, and very early in spring. The specimen in the College Museum is an old male bird,—the one I send an old female. To my great regret, I have not been able to obtain a more perfect sample of this pretty little flycatcher." [The specific term of *Rubecola Tytleri* was given to the bird referred to above by the late Professor Jameson, when he exhibited it at a meeting of the Wernerian Natural History Society in April 1835. He considered that in the form of the bill it presented as it were a link between the genera *Rubecola* and *Phœnicura*. The bird was sent to the University Museum by Lieutenant Tytler from the Himalayan Mountains. It is also a bird of eastern rare bird in England, only a very few instances of its occurrence being on record.] "I have added these few observations, as they perhaps may interest your ornithological friends. For the same purpose I have enclosed a catalogue of the birds that have, according to my observations, visited this island during the last fifteen years. If the small area of this place (scarcely half a square mile English) is borne in mind, the number of its feathered visitors will be admitted to be wonderful. As this catalogue (including some 320 species) contains the names of several specimens *hitherto not known as European*, it will, I trust, prove welcome to all who take an interest in the ornithology of our part of the globe."

Falco peregrinus
,, subbuteo
,, candicans
,, islandicus
,, gyrfalco
,, æsalon
,, cheuchris
,, tinnunculus
,, rufipes
,, palumbarius
,, nisus
,, rufus
,, cyaneus
,, cineracius
,, milvus
,, ater
,, buteo
,, lagopus
,, apivorus
,, nævius
,, albicilla
,, haliætos
,, brachydactyla
Strix otus
,, brachyotus
,, tengmalmi
,, noctua
,, flammea
Strix nyctea
,, nisoria
Corvus corax
,, cornix
,, corone
,, frugilegus
,, monedula
,, pica
,, glandarius
,, infaustus
,, caryocatactes
Lanius excubitor
,, minor
,, collurio
,, phœnicurus

Lanius rufus
Muscicapa grisola
,, luctuosa
,, parva
Bombycilla garrula
Sturnus vulgaris
,, roseus
Turdus viscivorus
,, musicus
,, solitarius
,, iliacus
,, pilaris
,, ruficollis
,, torquatus
,, merula
,, varius
,, saxatilis
,, rufus
,, lividus
Sylvia philomela
,, lucinia
,, cyanecula
,, leucocyanea
,, ruficyanea
,, rubecula
,, tithys
,, phœnicurus
,, erythrogastra (?)
,, hortensis
,, atricapilla
,, orphea
,, nisoria
,, cinerea
,, provincialis
,, turdoides
,, arundinacea
,, palustris
,, locustella
,, certhiola
,, aquatica
,, phragmitis
,, caligata
,, familiaris

Sylvia hypolais
,, sibilatrix
,, icterina (?)
,, trochilus
,, rufa
,, bonelli
,, javonica
,, bifasciata (mihi Regulus modestus)
(This bird I have obtained *eight* times in this island; four specimens being still in my possession.)
Sylvia virens (Wilson) (Oct. 19, 1858)
Regulus pyrocephalus
,, flavicapillus
Troglodytes parvulus
Cinclus aquaticus
,, pallasi
Accentor alpinus
,, modularis
Saxicola œnanthe
,, aurita
,, stapazina
,, leucura
,, rubicola
,, rubetra
Anthus Richardi
,, campestris
,, arboreus
,, cervinus
,, pratensis
,, ludovicianus
,, littoralis
,, aquaticus
Motacilla alba
,, lugubris
,, sulphurea
,, citreola
,, flava

Motacilla citrinella
,, melanocephala
Alauda arvensis
,, alpestris
,, arboreus
,, cristatus
,, brachydactylus
,, calandra
Emberiza miliaria
,, citrinella
,, cirlus
,, aureola
,, hortensis
,, cæsia
,, melanocephala
,, schœniclus
,, pusilla (above 15 times)
,, rustica (twice)
,, lapponica
,, nivalis
Fringilla cœlebs
,, montifringilla
,, nivalis
,, carduelis
,, citrinella
,, chloris
,, canabina
,, montium
,, linarea
,, spinus
,, coccotraustes
,, domestica
,, montana
Pyrrhula vulgaris
,, rosea
,, erithrina
,, enucleator
Loxia curvirostra

Hirundo rufula
,, urbica
,, riparia
,, melba
,, apus
Charadrius auratus
,, virginicus
,, longipes
,, squatarola
,, vanellus
,, œdicnemus
,, morinellus
,, asiaticus (Pall.)
,, hiaticula
,, cantianus
,, minor
Tetrao coturnix
Columba palumbis
,, œnas
,, livia
,, turtur
Rallus aquaticus
Crex pratensis
,, porzana
,, pusilla
,, pygmea
Fulica atra
,, chloropus
Grus virgo (once)
Ardea cinerea
,, purpurea
,, stellaris
,, minuta
,, ciconia
,, nigra
Ibis falcinellus
Numenius arquatus
,, phæopus

Tringa minuta
,, Temminckii
,, subarquata
,, islandica
,, maritima
,, calidris
,, interpres
,, platyrhincha
,, pugnax
Recurvirostra avosetta
Hæmatopus ostralegus
Cygnus musicus
,, minor
Anser cinereus
,, ... (?)
,, segetum
,, albifrons
,, minutus
,, hyperborea
,, leucopsis
,, torquatus
Anas boschas
,, strepera
,, penelope
,, acuta
,, querquedala
,, crecca
,, tadorna
,, fusca
,, nigra
,, perspicilata
,, marila
,, fuligula
,, ferina
,, nyroca
,, clangula
,, glacialis
,, stelleri
,, molissima

Larus Rossii
Sterna cantiaca
,, anglorum
,, caspia
,, Dougallii
,, hirundo
,, macroura
,, leucoparia
,, nigra
,, minuta
Lestris cataractes
,, pomarina
Lestris parasitica
,, crepidata
Procellaria glacialis
,, Leachii
,, pelagica
,, cinerea
,, anglorum
Podiceps cristatus
,, ruficollis
,, cornutus
,, auritus
Podiceps minor
Colymbus glacialis
,, arcticus
,, septentrionalis
Uria troile
,, tringria (?)
,, arra
,, grylle
Alca arctica
,, torda
,, alle

## IV. *On the Danger of Hasty Generalization in Geology.*

By ALEXANDER BRYSON, Esq.

After deducing examples of hasty generalization, and showing the frequency of erroneous conclusions drawn from scanty data, he gave the following example, of which he was himself guilty:—"In the summer of 1856, a few friends joined me in a yachting expedition, to geologise among the islands of the Firth. Among other islands we visited Inch Mickery, and spent some hours in examining its structure. On the southern summit of the rock, a quantity of lead was found, filling up many of the interstices of the trap, which had, besides, a very scorched appearance. This circumstance naturally excited our curiosity, and many theories were formed to unriddle the enigma, but in vain. We carefully examined the island, but could not find a trace of a fire by which the lead could have been melted, except at such a distance from the rock as to render the idea of lead being carried so far without cooling inadmissible. Then the lead had run into the crevices of the rock, showing that it must have been very fluid when it fell. The absence of every trace of carbon around the lead, or at all near the rock itself, was very puzzling. About this time our talented member, Dr Heddle, had announced the occurrence of native lead embedded in meteoric iron, and I at once held my Inch Mickery lead as truly meteoric in its origin. This idea was rendered the more probable, as Dr George Wilson, who kindly analysed it, failed to detect in it any trace of silver. Professor Fleming, although he scouted the notion of its meteoric origin, kindly accompanied us on a second visit to the island. After a personal examination, he was unable to throw any light on the subject, but advised us to wait patiently, and time might clear up the mystery. We would have rejoiced had he lived to learn the simple explanation only obtained a few months ago. The Board of Fisheries some years since took it into their heads that garvies were young herrings, and passed an act forbidding nets to be used the meshes of which were smaller than those employed in catching full-grown herrings. The officers of the Board happening to detect a boat using the illicit nets just off Inch Mickery, they, according to statute, took the offending nets to this rocky knoll and burned them. The leaden sinkers attached to the nets supplied my meteoric lead, and the twine yielded sufficient fuel to fuse it.

### V. *Notes on some points in the Natural History of the West Coast of Ross-shire.* By JOHN ALEX. STEWART, Esq., Lochcarron.

The first part of this paper was occupied with an inquiry into the food and some points of the natural history of the limpet. Besides the common species, ***Patella vulgata***, Mr Stewart had detected the finer species, ***P. athletica*** (which had hitherto been chiefly found in the southern coasts of Britain), in great abundance upon the coasts of Ross-shire and Skye. He satisfactorily proved that the food of the common limpet was not confined to sea-weeds, as was generally supposed, but that it also fed upon ***Balani;*** and that the chief food of the ***P. athletica*** was the ***Corallina officinalis***. Wherever that plant was in abundance, there ***Athletica*** was to be found; and it was not confined to the low-water zone, as it is in our seas. It belonged to the genus *Asteronyx*, described by Muller and Troschell in their work on star-fishes. It seemed doubtful whether it was the same species which they had described under the name of *A. Lovenii* from Norway. In the main, it very closely corresponded with their description, but there were one or two discrepancies, which might either be specific, or variations dependent upon the age of the animal. Mr Stewart had only found one specimen; therefore, in the meantime, he was not in a condition to give an opinion upon this point. Mr Stewart, in conclusion, gave some interesting notices regarding the pulsation of the snail as compared with that of other animals; and also some notices of peculiar geological features which he had observed in Ross-shire.

VI. *A beautiful Series of Varieties (in plumage) of the common Pheasant, were exhibited, the property of Walter May, Esq.* By ANDREW MURRAY, Esq.

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*Wednesday, March* 23, 1859.—WILLIAM RHIND, Esq., President, in the Chair.

JOHN S. LIVINGSTON, Esq., Leith, was elected a Member of the Society.

The following Communications were read:—

I. *Extract of Letter from the Rev. Hugh Goldie, Old Calabar, to Dr Greville, respecting some singular Silk "Bags" formed by Insects in Africa.* Communicated by W. H. LOWE, M.D.

The following extract of the letter was read by Dr Lowe, and specimens of the very curious "Bags" therein described were exhibited:—

"Last year a brother of King Eeyo undertook a trading expedition to Efeet. [This is a country lying on the side of the Camaroons Mountain, nearest the Old Calabar River.] In the smaller box you will find something which he brought to me as a curiosity, it being quite unknown in Calabar. The articles are small bags, woven by what would appear to be an insect of the same family as the silkworm. The insects are said to form these on trees, many working at one bag; and, having completed their task, each one rolls himself up in his own shroud and dies. The people of Efeet sometimes take a number of insects and put them in one of their native pots, when they commence to work, and line the interior of the pot with their bag, by which means the people obtain large ones, which they use to put cloth in, or any light article, and which are said to be waterproof."

Dr Lowe regretted that, while the objects were of themselves of the highest interest, he was able to offer so little in the way of information respecting them. There was no doubt, however, that they were the production of lepidopterous insects, and this belief was confirmed by Mr Andrew Murray, who brought to the Society an excellent drawing of some bags extremely analogous to those exhibited, and which are known to be the production of a gregarious butterfly in Mexico, a description of which, together with an illustrative plate, will be found in the Transactions of the Entomological Society of London, vol. i. p. 38, published in 1836. As one of the bags from Africa was much more dense in its texture than the others, Dr Lowe was led to think that two species of insect had been employed; but Mr Logan thought both might be produced by the same butterfly or moth. Mr J. T. Syme added some remarks; and all the members joined in the hope that specimens of the insect, in any state of transformation, or however roughly preserved, might at a future time be procured by the kind agency of Mr Goldie.

was supposed by Lacordaire and other authors. Mr Murray mentioned a number of interesting facts relating to the economy and structure of these blind insects.

### III. *Notice of the Tenacity of Life in* Buccinum coronatum.

### By Alexander Bryson, Esq.

On the 6th September 1857 we reached Marseilles on our way to Naples. Having a full day to spend before the steamer sailed, we drove to the Prado la Mer to search for shells on the shores of the Mediterranean. On the sandy downs, close by the margin of the sea, we found many Helices which were new to us (*Helix vermiculata*, *virgata*), and others well known to the south of Europe. They seemed very gregarious, and we could collect them by handfulls. The shores of the Mediterranean do not afford a fertile field for the conchologist, as the tides scarcely ever vary more than three feet. We picked up a few *Naticæ*, and also a specimen of *Buccinum coronatum*, the tenacity of life in which is the object of this notice. We placed the Buccinum along with our Helices, and packed them all carefully in boxes, where they lay until May 1858. On opening up the packages we found the Buccinum closely adherent to one of the Helices, but thought at the time that it was dead. We threw them all into a basin of tepid water, and found shortly that most of the Helices were alive, as was also the *Buccinum coronatum*. We lost no time in placing it in the marine aquarium of a friend, where he seemed quite at home and lively. Unfortunately, however, in a few days he came too near a hermit crab, who soon devoured the poor Buccinum. The Helices lived in the conservatory for some months, until the cold weather killed them. As this is the first instance of which I have heard of the tenacity of life exhibited by a marine mollusc, I thought it should be recorded.

While we were strolling along the shores we saw a novel method of fishing for sardines and anchovies. The fisherman wades into the water nearly to the middle, and is furnished with a large circular net, round the periphery of which is attached a series of leaden bullets. A long rope is attached to the centre of the net, which he throws out in a very skilful manner to the full extent of his line. The resistance of the air and the centrifugal force causes the net to expand like a flat old-fashioned umbrella, in which shape it reaches the surface of the water. The weight of the bullets causes the descent of the circumference, and the net assumes an oval form, and the tiny fish are caught by the meshes in their attempt to escape.

Mr Bryson also took the opportunity of reading the following note he had received from his friend Dr James M'Bain, R.N.:—

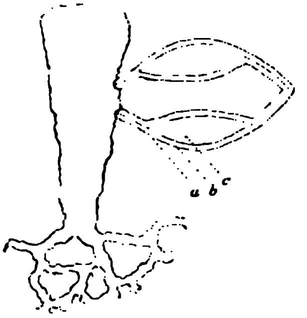
"As an additional instance of the tenacity of life in certain species of the mollusca, I may mention that in the spring of 1857 a small *Helix* was picked out from amongst some dried raisins, and handed over to me by one of my family. As it had the thin, transparent, glistening film covering the aperture, it occurred to me to repeat the experiment related by Dr Baird, in reference to the Egyptian desert snail in the British Museum, and included in the examples of tenacity of life in these animals given by Mr Woodward in his 'Manual of the Mollusca.' The following day our shy friend made his appearance in the glass vessel, and lived with us for five months. It was occasionally supplied with a little water, and portions of green vegetables, such as cabbage and lettuce, and seemed to give a preference to the latter. It was precisely identical with specimens of *Helix virgata* got at Shotover Hill, near Oxford, along with our friend Dr Melville in 1847. This species is widely spread over the south of Europe, and, although having no objection to the interior,

## IV. *Observations on British Zoophytes.* By T. Strethill Wright, M.D.

### *Kionistes retiformis* (κίων-ἵστημι).

**Polypary retiform—alimentary polyps minute, white, with single row of short tentacles—reproductive polyps columnar, thickened towards apex, without tentacles, bearing many generative capsules.**

A male specimen of this zoophyte was found growing in an old shell at Granton in May 1857. The corallum consists of a close network of flattened chitonous tubes, from out of which the alimentary and reproductive polyps spring at intervals. The sperm-sacs (one of which is shown in the marginal woodcut) attached to the reproductive polyp differ from those of Hydractinia, in having the endoderm attached to the ectoderm at their distal extremities, as I have figured in the sperm-sac of Eudendrium. This zoophyte approaches the Sertulariadæ in the simple columnar form of its untentacled reproductive polyps, and forms the connecting link between the Tubulariadæ and Sertulariadæ. Thus we have:—



Reproductive polyp of *K. reteformis* with single sperm-sac: *a*, endoderm, *b*, ectoderm, *c*, cavity containing spermatozoa.

| | |
|---|---|
| Sperm or egg sacs attached to ordinary alimentary polyps, as in . . . . . . . | Clava, Coryne, &c. |
| Sperm or egg sacs attached to reproductive alimentary polyps, which differ from ordinary alimentary polyps in having fewer tentacles, as in | Podocoryna fucicola (*Sars.*) |
| Sperm or egg sacs attached to reproductive polyps, with rudimentary mouth and tentacles, as in | Hydractinia. |
| Sperm or egg sacs attached to reproductive polyps, without mouth or tentacles, as in . . | Kionistes, Sertularia. |

## V. (1.) *On the Vomer in Man and the Mammalia, and on the Sphenoidal Spongy Bones.* By John Cleland, M.D., Demonstrator of Anatomy in the University of Edinburgh.

The remarks which I am about to make will be confined as much as possible to matters of observation. I shall resist the temptation to enter on the question of the constitution of the vomerine segment of the skull, although it is one on which the statements to be made have an important bearing; I shall content myself with exhibiting the relations of this bone in different mammalia, and, founding upon these and on development, shall show how the vomer in man corresponds in its relations to those of other animals, and what is the nature of the sphenoidal spongy bones.

Last autumn, while disarticulating the skull of a lamb, it came prominently under my notice that the central plate of the sphenoid bone adhered without marks of separation to the presphenoid, while the lateral masses of the ethmoid and the vomer formed one other single piece. On further examination I found that in mammalian skulls the formation of one piece by the vomer and lateral masses of the ethmoid was the general rule, and their separation a rare exception. This is a circumstance so easily seen that one would think it could hardly escape the notice of any one in the habit of disarticulating mammalian skulls, yet I can find no description of it by authorities on human and comparative anatomy. It is, however, as we shall see, the most important of all the connections of the vomer, and throws some valuable light on human anatomy. With respect to the other articulations of the vomer, we shall see, that that with the central plate of the ethmoid is by no means a primary one, and that the most constant of those of its inferior margin is that with the intermaxillary bones.

In the *ruminantia* it is a well-developed elongated bone.

framework of that bone. On the upper aspect there is a sharp angle between the laminæ that lie against the cartilaginous septum and their lateral expansions, and the former are prolonged in many animals beyond the angle. Where the ethmoid is joined by the ethmo-vomerine lamina—for so we shall call the expansion just described—it forms the upper part of the nasal foramen of the palate bone, in human anatomy called the spheno-palatine foramen. In the lamb there is not much development of the vomer as a mesial plate below the level of the groove. It articulates inferiorly by a rough sutured edge with the superior maxillary bones, and in front of that its scooped anterior extremity lies for about an eighth of an inch or so on the groove formed by the mesial processes of the intermaxillary bones—the universal method of articulation of the mammalian vomer with the intermaxillary bones (fig. 1).

The vomer of the *cat* is proportionally less elongated than that of the sheep, but like it has little development of the mesial plate beneath the vomerine groove. It articulates by a rough surface with the superior maxillary and palate bones, but with the intermaxillary bones by an elongation forward upon them of the laminæ which bound the groove. These laminæ are connected towards their back part with the lateral masses of the ethmoid, exactly as is the case in the sheep; and at the point where the vomer passes into the ethmoid, the latter presents a minute orbital surface, which lies between the two ascending processes of the palate bone, and completes by a point in its inferior margin the almost perfect nasal foramen of that bone. The sphenoid process of the palate-bone lies between the ethmo-vomerine laminæ and the pterygoid bone. The central plate of the ethmoid does not at all touch the vomer in early life, but the cartilaginous septum of the nose passes back beneath it to the presphenoid bone.

It may be mentioned at once that the nasal foramen of the palate bone is completed by the ethmoid in all the animals examined.

The relations of the vomer in the *fox* and the *pig* are the same as in the cat. In the case of the *hedgehog*, as in the sheep, it does not articulate with the palate bones. In the *horse* also it does not articulate with the palate bones. But the superior connections of the vomer in the horse are peculiar, inasmuch as the inferior surface of the leaflets of the ethmoid, instead of lying in contact, as is usual, with the ethmo-vomerine lamina for a considerable extent, is completely floored in by the upper part of the palate bone, which is expanded for that purpose. Even in the horse, however, a slender lamina, immediately in front of the palate bone, and in contact with its nasal foramen, passes downwards and inwards on each side from the framework of the ethmoidal turbinations to the margin of the vomer; but the vomer and it are not anchylosed until other sutures also have begun to be obliterated.

The vomer in the *rodentia* is remarkable in having very little tendency to come in contact with the superior maxillaries. As far as I have observed, it is always continuous with the lateral masses of the ethmoid.

In the skull of the *rabbit* there is only one great anterior palatine foramen; for, although the mesial processes of the intermaxillaries project well backwards, the palate plates of the superior maxillaries do not come far enough forwards to meet them. The vomer does not at all approach the superior maxillaries; its posterior margin terminates inferiorly in a thickened angle, which articulates with the intermaxillaries in such a manner as to make their inferior aspect continuous with the posterior margin of the vomer. In front of this, the laminæ bounding its groove are prolonged on the upper surface of the intermaxillaries, as we have seen in other animals (fig. 4).

*The vomer and sphenoidal spongy bones in man.*—Having found the vomer and lateral masses of the ethmoid so universally connected, we naturally inquire how they are related in man. They are not in contact. Their only connection is that the expanded portion of the vomer which grasps the rostrum lies beneath the sphenoidal spongy bones, and that these articulate with the lateral masses of the ethmoid. Now, seeing that the sphenoidal spongy bones are recognised as ossifications distinct from the sphenoid, I think we have already sufficient evidence to prove that they represent the ethmo-vomerine laminæ, by aid of what we have noticed in the Chimpanzee's skull; for it is impossible to doubt either that the distinct bone which lies between the orbital plates of the ethmoid and the vomer in that skull corresponds to the ethmo-vomerine lamina of other monkeys; or, on the other hand, that it corresponds to the sphenoidal spongy bone in man. But the correspondence becomes much more distinct when we study the early condition of the sphenoidal spongy bones. The most interesting condition of these bones is when, in the skulls of young children, they can be got completely ossified and not yet destroyed by amalgamation with the neighbouring bones. In this state the sphenoidal spongy bone is somewhat of the shape of a hollow pyramid with the apex directed backwards, its inner aspect parallel to its fellow, and its cavity (the first form of the sphenoidal sinus) opening at its base into the nasal cavity in front (fig. 2). This pyramid is constructed by the union of at least three distinct pieces of bone. Firstly, there is an orbital piece, forming a portion of the wall of the orbit between the ethmoid and sphenoid, an element, I believe, in the formation of the orbital wall not hitherto observed. It articulates with the orbital process of the palate bone, and, together with the inferior piece, completes the nasal foramen of the palate-bone, namely, the foramen called spheno-palatine, but which we have seen to be invariably ethmo-palatine in other animals. The superior piece bounds the sphenoidal sinus above and on the inside, and ultimately becomes incorporated with the sphenoid bone. The inferior piece is the largest of the three; it forms the floor of the sphenoidal sinus, and the under half of its opening in front, and includes the greater part of what has hitherto been recognised, and described under the various names, sphenoidal spongy bone, sphenoidal cornu, and bone of Bertin. Its inner margin is joined by the superior piece at an acute angle, and is prolonged downwards and forwards so as to lie edge to edge with the corresponding lamina of the vomer. immediately in front of the thick dilated part of that bone. Beneath and behind is the sphenoidal process of the palate-bone. and behind that is the internal pterygoid process. In man, therefore, as in other mammalia. we find three processes in succession from behind forwards, viz., the pterygoid bone, the sphenoidal process of the palate-bone, and an arch passing from the ethmoid to the vomer, adapted to it edge to edge: and moreover, this arch completes the foramen which divides the ascending part of the palate-bone. It in every respect, therefore. corresponds with the ethmo-vomerine lamina. The reason why the arch formed by the vomer and ethmoid is broken up in the human subject into so many separate pieces is to be sought in the characteristic peculiarities of the human subject, particularly in the very slight development of the organ of smell, and the rapid curvature of the cranio-facial arch. But on this subject I hope to speak more fully on some future opportunity. The inferior edges of the sphenoidal spongy bones, which in childhood lie edge to edge with the vomer, are in the adult state smoothed down to a mere ridge, and considerably separated from the middle line by the ex-bones. But this surface ceases abruptly in front, and only the lamina bounding the groove for the cartilage is prolonged on the intermaxillary part of the palate (fig. 3). In the adult state both the scooped projection lying on the intermaxillaries, and the remains of the surface for articulation with the superior maxillaries, can be seen, when the vomer still admits of being accurately disarticulated. But this is not often, as it soon becomes anchylosed with the neighbouring bones; and even when this has not happened, it requires that portions of the other bones be sacrificed for the sake of removing it entire. As the face elongates, the upper part of the vomer undergoes much alteration; not only is there a considerable development of lamina in the mesial plane beneath the groove, but usually the laminæ bounding the groove deviate from the mesial line, and one of them becomes more developed than the other, and is more extensively anchylosed with the central plate of the ethmoid, which, growing downwards, replaces the cartilage between them. In consequence of these changes taking place at a comparatively early period, the specimens which are sold with disarticulated skulls, and from which the descriptions in text-books are drawn up, are seldom complete, and have most frequently more or less of the central plate of the ethmoid adherent to them. Thus the vomer is described as exhibiting at its upper and back part a cul-de-sac for the rostrum. Such a cul-de-sac is often seen, but the central plate of the ethmoid invariably enters into its formation, for it is only the ethmoid, and never the vomer in the slightest degree, which replaces the cartilaginous septum.

### *Explanation of Plate V.*

*Fig.* 1. The vomer and lateral masses of the ethmoid of a lamb, seen from below. *a*, The inferior margin of the vomer, rough posteriorly, for articulation with the maxillaries, and smooth in front, where it comes in contact with the intermaxillaries; *b b*, the grooves which complete the nasal foraminæ of the palate bones. The spaces between the grooves and the margins of the vomer represent the ethmo-vomerine laminæ, and on the outer aspects of the grooves are the small orbital surfaces of the ethmoid.

*Fig.* 2. The vomer, ethmoid, sphenoidal spongy bones, and left palate and maxillary bones, from the skull of an infant; seen from behind (slightly enlarged). *a*, Orbital plate of the ethmoid; *b*, posterior extremity of the vomer; *c*, sphenoidal process of the palate bone; *d*, orbital surface of the palate bone, and immediately above it is the orbital portion of the sphenoidal spongy bone. Between the two processes of the palate bone is the spheno-palatine foramen, completed above by the inferior portion of the sphenoidal spongy bone. *e*, The superior portion of the sphenoidal spongy bone.

*Fig.* 3. Another view taken from the same specimen: *a*, *b*, *c*, The parts of the inferior margin of the vomer for articulation with the palate, maxillary, and intermaxillary bones respectively; *d*, inferior aspect of the sphenoidal spongy bone; *e*, orbital plate of the ethmoid seen in perspective; *f*, inferior turbinated process of the ethmoid.

*Fig.* 4. Illustrates the articulations of the vomer in the rabbit. Above are the vomer and ethmoid forming one bone. Beneath are the bones of the upper jaw of the left side, and a portion of the intermaxillary bone of the right side adhering to it. *a*, Anterior extremity of the vomer, grooved for the cartilaginous septum of the nose; *b*, the part of the vomer which articulates with *c*, the extremity of the expanded mesial processes of the intermaxillary bones, forming turbinations in connection with Jacobson's organ.

## VI. *On the Discovery of Nullipores (Calcareous plants) and Sponges in the Boulder Clay of Caithness.* By CHARLES W. PEACH, Esq., Wick. (Specimens were exhibited.)

In a paper read to the Society in March 1855, "On the Calcareous Zoophytes of the Boulder Clay of Caithness," I intimated that, at a future time, it was my intention to give you one on the flora of that formation. I have delayed from time to time, that I might search in wide localities, and thus have succeeded in procuring several specimens at Wick, and the burns of Haster and Freswick.* Mr Cleghorn has also found specimens at Wick, and Mr Dick in and around Thurso. Although pretty widely distributed in the country, nowhere is it found in abundance. At times it is quite soft when first

Burn on one of my official visits, I noticed the sections of boulder clay exposed there; not having time then to devote to their examination, I thought that, although fourteen miles distant from Wick, I would try my pedestrian powers and do so, on the day kept for the Queen's birthday (1855), should the weather prove fine. It did, and I was off early in the morning, so that I might have a long search, not only in the exposed sections of the boulder clay on my route, but every quarry and place of interest. On searching the Burn of Freswick, I commenced immediately at the bridge, and in the blue clay there found several flints, evidently from the chalk, hinges and portions of *Cyprina*, fragments of *Turritella*, *Dentalia*, &c., all more or less broken and rubbed. These were firmly embedded, and so were all the specimens taken by me from the boulder clay. After examining the sections above the bridge, I retraced my steps, passed over the road and down the burn towards the castle, and in a nice section worn by the stream, as well as the usual stones, shells, &c., I met with a white mass, which at first, from its yielding freely to the knife, I thought chalk. After digging it out and washing it in the stream, I was surprised to find that *it would swim like cork*, and therefore could not be chalk. I put it carefully into one of my boxes, and searched again, and at some distance from the spot where I found the first I got a smaller piece of the same description. They are the only pieces I have met with. I have forwarded the smallest piece with this paper, enclosed in glass, and hope that you will excuse my jealous care in thus preserving the precious relic. As soon as I had fully examined all the exposed clay, I turned my steps homeward, wondering all the way what my swimming prize could be. As soon as possible, after washing and taking my tea, I out with a microscope, and placed a small portion of the mass under it, when, to my delight, bundles of spiculæ, and quantities of siliceous globules, were beautifully shown, as well as straight spicula, triradiate, and other shapes; the spicula hollow in the centre. I fancied it might be a *Pachymatisma;* but then the stellate forms were absent. It effervesced freely in dilute muriatic acid. In order to be set right, I forwarded a portion of each piece to Mr Bowerbank of London, who, with his usual kindness, examined them, and informed me that they were *Geodia;* the species he could not tell. He farther added, "that he had found *Geodia* in a flint in the chalk; therefore this sponge appears to be more ancient than had been suspected." We have *Geodia zetlandica* in our northern seas (see Johnston's "British Sponges," pl. iii., figs. 3 and 4, and described at page 195). I also met with that species in Cornwall. The piece mounted in Canada balsam will show the spicula and siliceous globules. Here, then, was a reward; for not only did the walk of at least thirty-two miles prove beneficial to the body—the mind truly enjoyed a feast; the numberless objects of beauty that stud the path of the naturalist makes all roads cheerful; and if I were to add a list of the attractions of that day, it would, though interesting, be a long one. It will be sufficient for me to say, that the excitement caused by every new beauty drove weariness from the body—mind triumphed over all—and to me this was a "Queen's day" indeed! The pleasure did not cease with the day, for my collection of stores has given me much useful employment since. Add to this, the satisfaction of knowing that I had turned up a new leaf in the history of this long-gone period. Long gone as it may be, its history is linked to the present; for the ancient organisms of the seas of the clay period have direct descendants now living in our seas, and although from our present knowledge some may be wanting, either of the past or the present, the advancing march of retions have been destroyed; there is, however, *no doubt about the genus.* Many species "existed during several geological periods; for instance, in the Crag, in the London Clay, in the Paris Basin, in the Chalk, in the Greensand, and in the Oolite. Mr Alder has detected it in a specimen of *Pecten islandicus* from a raised beach at Bute," and to this list is now to be added the boulder clay of Caithness. Many species of *Clionia* also now exist in our seas, as shown in Mr Hancock's delightful paper, published in the 3d vol., second series, 1849, of the "Annals and Magazine of Natural History," from which the above quotations were taken. I again beg to apologise for so long delaying this paper. I trust that the additional matter and facts collected by that delay will plead an excuse for me. It is pleasant, when working in this once said to be barren field, to be rewarded by adding to the shells of the age, first zoophytes, and now sponges and plants.

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*Wednesday, 27th April* 1859.—T. STRETHILL WRIGHT, M.D., President, in the Chair.

Thomas Boyle Grierson, Esq., surgeon, Thornhill, Dumfriesshire, was elected a non-resident member.

The usual Committees were appointed for conducting special investigations during the recess.

The following donations to the Library were laid on the table:—

Memoirs of the Literary and Philosophical Society of Manchester, new series, vols. iii. to xiv., and part 1 of vol. xv.—From the Literary and Philosophical Society of Manchester. Mèmoires de la Sociétè Imperiale des Sciences Naturelles de Cherbourg, tome v., 1857.—From the Society. The Canadian Journal of Industry, Science, and Art, new series, No. xix., January 1859.—From the Canadian Institute, Toronto. Première Centurie de Longicornes du Vieux Calabar. Par Auguste Chevrolat. Paris, 1858.—From the Author.

The communications read were as follow:—

### I. *Report on the Pearl Banks of Arippo, Ceylon, for Season* 1858. By E. F KELAART, M.D. Communicated by Dr R K. GREVILLE.

In this paper the author states that he found in most of the pearl-bearing shells a worm (a species of *filaria*), which he considered had much to do with the formation of pearls. This worm he found in large numbers in the liver, ovary, mantle, and other parts of the oyster. He also considered, from his researches into the subject, that the ova of the oysters and the ova of worms form the nuclei of many pearls found in the soft parts of the animal, according to the doctrine of Sir Everard Home. This theory has, however, been called in question by many authors. Dr Kelaart had sent for examination specimens of ovaries, containing pearls of various sizes, to the Museum of the Royal College of Surgeons, London, which he considered tended to prove the truth of these views. In pearls adherent to the shell he found the nuclei to be sand, portions of sea-weed, and larvæ of insects, &c. In conclusion, Dr Kelaart recommended that only the larger and more matured oysters should be fished, and that portions of the banks should be reserved for breeding purposes.

Mr Alexander Bryson believed pearls to be the result of disease or of irritation, caused by the presence of foreign bodies. He stated that, in all his experience, he had found a nucleus of foreign and structureless matter, generally siliceous; also, that he could, by examining the microscopic structure of a pearl, at once infer what shell had produced it.

### II. *Note on the Lantern Fly of Honduras.* By Mr James Banks. Communicated by Dr J. A. Smith.

At a previous meeting a specimen of the lantern fly (*Ful-*

hree luminous spots, one on each side of the head part, on the ıpper part (like a cat's staring eyes), of a beautiful sulphur-coloured light, in rays that spread over the room. The third luminous spot is seen when the fly is on its back, half way down the abdominal part of the insect. When quiescent, the lumination is least; in daylight the upper spots are nearly white, emitting no light whatever (its lively time is at twilight). Immediately on being agitated, or moving about, the spots become sulphur colour, and radiate forth streams of light, clearly seen, although the sun be shining into the room, as it now does at the moment I write, with the creature in the glass tumbler before me. We put out the lights, and to test the power of the fly, I took up my psalm-book and read two verses of Psalm cix. Mr Robert Gegg also took up a book at random, and read by its light. I hope this will satisfy all that the lantern-fly is indeed luminous." He had also a letter from Dr John Young, Belize, kindly offering to make any observations the Society might desire. A published statement, in the "History of the West Indies," by R. M. Martin, 1837, vol. ii. p. 104, being vol. v. of British Colonial Library, corroborating the truth of the lantern-fly being luminous, was also referred to.

## III. (1.) *Notice of a Fossil Nautilus from the Isle of Sheppy.* By JAMES M'BAIN, M.D., R.N.

Dr M'Bain said, that the specimen of a fossil nautilus which he exhibited to the Society was obtained from the Isle of Sheppy, along with other fossil remains, and presented to him by his friend Dr Easton, of H.M.S. Pembroke. Before placing the specimen in the public museum of Edinburgh, which, under the present energetic management, was rapidly assuming a highly scientific character, he considered it advisable to give a short description of the state of preservation of the shell, and the locality whence it was derived. The species agreed with the description of the *Nautilus Sowerbyi*, given in a monograph of the Eocene Mollusca, by F. E. Edwards, and published by the Palæontographical Society. The specimen he exhibited was seven inches in diameter by four inches across, measured from one umbilical space to the other. It had lost the whole of the outer or inhabited chamber, but the triangular shape of the aperture was distinctly shown by the compressed ventral margin of the remaining part of the shell. The position of the siphuncle—said to be close to the dorsal margin—seemed to be indicated by a small deposit of iron pyrites, probably caused by the organic matter having been longer retained in that canal. The interior of the shell was filled with a ferruginous clay, containing a large proportion of carbonate of lime, a stalagmitic layer of which was seen encrusting a portion of the mass. Defoliation of the outer porcellanous coat of the shell had taken place, but what remained of the inner nacreous layer showed the striæ of growth bending sharply backwards in well-marked undulations. If the proportions of the fossil specimen were similar to those of the recent *Nautilus pompilius*, the shell, when entire, would have measured about fifteen inches in diameter. Dr M'Bain stated that the Nautilidæ were in some respects the most interesting family in the molluscan sub-kingdom. They formed the type of the second order, Tetrabranchiata of Owen, in the class Cephalopada, of which upwards of 1400 fossil species have been disinterred from the Palæozoic and Mesozoic rocks. Of all the genera constituting the Tetrabranchiate order of mollusca that existed in the ancient seas, the nautilus was the only one that had been found to pass into the tertiary formations, and there were at least two species still existing in the seas of the tropics. Six fossil nautili were stated by Mr Edwards to have been found in the older nterstratified layers of concretionary nodules, commonly alled septaria or cement stones. This clay belonged to the lower tertiary formation, and formed a part of the London basin—one of those isolated fluvio-marine deposits which took place in hollows of the chalk subsequent to the cretaceous epoch. On the north side of the island, and eastward from Sheerness, the cliffs rise to the height of from one to two hundred feet, and, chiefly from atmospherical causes, were constantly crumbling down in large prismatic masses, which gradually broke up, and formed a flat shore of fine silt. Mud banks extended off shore for about half a mile, and at low water workmen were employed in procuring the cement stones. The beach was not more than from ten to twenty yards wide, on which were strewed abundance of fossil fruits, wood, crustacea, and mollusca, which had fallen out of the clay. Dr M'Bain said, he had frequently obtained upwards of a hundred Eocene fossils in a single excursion, and that the remains of fish and reptilia were also of frequent occurrence in the London clay of the Island of Sheppy. He added, that many of these Eocene fossils became mixed with recent organisms, and were buried together in the re-composed silt, which the hasty generalization of some palæontologist, in a future new geological epoch, might consider as a sufficient proof that they also lived together at the same time in the Cainozoic period.

### (2.) *Notice of the* Nucula decussata, *found in the so-called Raised Sea-beach Bed at Leith.* By James M'Bain, M.D., R.N.

The members of the Society, Dr M'Bain said, were no doubt familiar with a bed of sand and gravel extending along the shores of the Forth in a more or less continuous manner, and generally known as the raised sea-beach bed. This deposit had been considered by several eminent geologists to represent an ancient sea-beach, which, in consequence of a general elevation of the land, had been raised twenty feet or more above the level of the sea, at a comparatively recent geological period. This view was strenuously opposed by the late Professor John Fleming, who maintained that this so-called raised sea-beach bed and other accumulations of a similar structure, at still higher levels, derived their origin from "ground storms" or sudden risings of the sea, by which shells, sand, and gravel, had been placed in situations now considerably removed from the influence of the tide. Professor Fleming had arrived at this conclusion as early as 1806, from examining a bed of shells, chiefly composed of the common oyster shell, to the westward of the town of Borrowstounness, in the county of Linlithgow, and stretching along the banks of the Forth into Stirlingshire. The raised sea-beach controversy forms nearly the whole of the last chapter of his last work—"The Lithology of Edinburgh." Any new fact, therefore, connected with this distinct marine deposit would be of interest. This raised sea-beach bed is well exposed in many parts of the coast between the sandstone quarry at Granton and the Magdalen Burn near Fisherrow. It varies in thickness from two to ten feet, and contains abundance of comminuted shells, with many in a more or less perfect state of preservation. The horizontal position of the bed in respect to the present high-water level is by no means equal. At Granton quarry, the base of the bed is about ten or twelve feet above high-water mark, and rests upon the sandstone and boulder clay; whereas a quarter of a mile to the eastward, at a ledge of rocks projecting sea-ward, it is only two or three feet above high-water level. The bed is then interrupted by a sea-wall, until at the east end of the village of Newhaven, at the collection of boulders that form a boat harbour, it is of artificial soil, the continuation of the sand and gravel bed was observed to cover the boulder clay at six or eight feet above high-water level. In a section made for the foundation of the east wall of the building, the boulder clay was cut down to the depth of 12 or 14 feet; and in the sand and gravel-bed overlying the clay at this part, amongst other shells usually found in this bed, a detached right valve of a Nucula was obtained, having the sculpture and characters of *Nucula decussata*. The epidermis was well preserved, and of an olive-green colour. It was marked with concentric wrinkles, and strongly raised radiating striæ, with short but distinct transverse plicæ on the dorsal area. The inner surface was pearly white, and had a crenulated margin, with twelve pectinated teeth in front of the cartilage-depression, and about double that number behind. The valve was rather more elongated, and larger than the ordinary examples of the common *Nucula nucleus*.

The *N. decussata* is not recorded as having been found in the Firth of Forth, but it lives on the west coast of Scotland, and in the Hebrides, and is said by Löven to be a Swedish shell. The specimen was accidentally broken, and the fact of the valve having been found is only recorded to direct attention to a closer scrutiny of the marine contents of this deposit, especially in sections inland from the present high-water level; as the lateral extent of this so-called raised sea-beach bed, and its relation to other accumulations of a similar lithological structure, but destitute of any trace of marine remains, had not been satisfactorily determined.

### IV. *Contribution to a Monograph of Iceland Spar.* By ALEXANDER BRYSON, Esq. Part I.

This communication will be given complete (along with Part II.), in a future fasciculus of the Proceedings.

### V. *On a Method of constructing Polarizing Prisms of Nitrate of Potash.* By T. STRETHILL WRIGHT, M.D.

Dr Wright stated that many doubly-refracting substances, when immersed in dense and transparent fluids, had, as was well known, the property of polarizing light. This polarization of light was not effected by the whole surface of the substance, but only by inclined parts of it which intersected the ray in an oblique direction. In passing through such parts a beam of light was divided into two rays polarized in opposite planes. The one ray continued its original course, while the other suffered deflection proportionate to the inclination of the polarizing surface, and was thus entirely thrown out of the field of view. It occurred to the author that large crystals, having their surface artificially inclined, might, when immersed in a highly refractive fluid, be used as polarizing prisms, and he had succeeded in thus forming polarizers, one of which he placed before the Society, and which was found to be well adapted for application to the microscope. It consisted simply of a wedge of nitrate of potash, cut from one of the angles of a large crystal, and put up in a cell filled with castor oil.

Dr Wright stated that very beautiful objects for the polariscope might be formed of clear plates cut from the surfaces of large crystals of nitre, and grooved in various designs. These, mounted on a colouring plate of mica, and enclosed in a plate-glass cell filled with oil of turpentine, gave rich effects of changing tint when traversed by light reflected from a glass plate or from the northern sky. Large planes of parallel polarizing crystals might be produced by crystallizing muriate of morphia on slightly inclined plates of glass, and might be removed so as to leave designs. These figures, when mounted the author said, for his late friend, Mr James Brown, a young chemist, who, by his labours and discoveries in the science to which he had devoted himself, gave promise of an active and useful life, which was, however, cut short by an attack of cholera, that in a few hours proved fatal. His retiring manners and devotion to his work made him unknown, save to a few friends, who were thus unexpectedly called to mourn the loss of one who seemed destined by his labours to command the respect of the scientific world; and the collection was some months ago placed in the hands of the writer by his father. It consists of nearly 1000 different specimens, with accompanying manuscripts, drawings, and sections, most elaborately executed. Valuable memoirs had been published by Mr Bain on the geology of South Africa; but he did not seem to have visited Du Toit, the locality where the fossils on the Society's table had been gathered, as it was not mentioned by him. Du Toit is about thirty-five miles north-west from Swellendam. It is situated on the further side of the Lange Bergen Mountains, on the oldest beds of what, from palæontographical evidence, seems to be the Old Red Sandstone. The fossiliferous beds are composed of coarse sandstones and shales. The fossils are chiefly brachiopod mollusca, and include *Spirifer antarcticus*, and *Orbignii*, *Terebratula Bainii*, *Orbicula Bainii*, &c., *Solinella antiqua*, and other bivalves. Besides these there were only some Encrinite stems, and the cast of a Trilobite, neither of which could be more specifically described, owing to their bad preservation. Mr Carruthers noticed the remarkable condition in which the clay slates of the metamorphic series exist in the vicinity of Swellendam, where they have little more consistency than dried alluvial brick clays, so soft as to have permitted Mr Bain to drive a tunnel of 400 feet through them by the aid of the pickaxe and spade alone. The induration increases, however, until in other localities the rocks become, as Mr Douglas says, "exceedingly hard, siliceous, and splintery, so as to cut the hand when incautiously griped."

### VII. *Ornithological Notes.* (Specimens were exhibited)

(1.) *The Gadwall,* Anas strepera, Linn. By P. A. Dassauville, Esq.

This species being of rare occurrence in Scotland, Mr Dassauville thought it might be of interest to show the two specimens now before the Society. They were shot on the Tay, near Newburgh, in the beginning of April, and are a male and female, as was proved by dissection, the ova of the female being numerous, but not far advanced. Mr Dassauville was aware of the danger that specimens obtained, as these were, in the poulterers' shops, might not be actually procured in this country, since importing wild fowl from the continent was so general; but the specimens under notice were evidently so recently shot—the feet and webs being quite soft and flexible—that he had no hesitation in believing they were killed in this country, without other evidence; however, he had been obliged with a sight of the invoice which accompanied them, dated from Perth, and felt satisfied there was no room to doubt that they were procured from the locality mentioned. One or two sessions ago Dr J. A. Smith exhibited to the Society specimens of the gadwall, and these were the only others he had seen that were killed in Scotland.

(2.) *The Shoveller,* Anas clypeata, Linn.; *the Great Grey Shrike,* Lanius excubitor, Linn.; *the Shore Lark,* Alauda alpestris, Linn. By John Alexander Smith, M.D.

never seen a specimen of the bird before, although he had lived for many years in the district.

The last bird Dr Smith had to notice was the Shore Lark, *Alauda alpestris*, Linn. It is a bird of very rare occurrence, being apparently only an accidental straggler in this country; in the north of Asia, Europe, and especially America, it abounds, and migrates southwards in the autumn to more temperate regions. The first specimen noticed in England was in 1830, and only one or two have been observed since. He had not been able to find any recorded as taken in Scotland. This bird was killed by Mr Evans, Tynefield, about the 10th of January last, near the mouth of the Tyne, and its plumage was unfortunately much destroyed by the shot. It is a fine old male, having the back brown; tinted on the head, neck, and shoulders, of a rich vinaceous colour; the streak over the eye, the forehead, and the ear-coverts, yellow; and with the lore and a gorget of black; under parts dull white, and flanks pale reddish brown; axillaries white. It is the property of Dr C. Nelson, Pitcox, near Dunbar, to whom it was presented.

## VIII. *Notes on the Crania of the Urus* (Bos primigenius) *in the Museum of the Society of Antiquaries of Scotland.* By John Alexander Smith, M.D.

Some years ago, when gathering up various details in reference to the ancient small short-horned cattle of this country, my attention was also directed to the large cattle (*Bos primigenius*), and to the specimens of crania in the Museum of the Society of Antiquaries. I took various measurements of these crania, and searched the early records of the Society for such information in regard to the places where they were found, and any other details that might be of interest; and as Mr Turner has favoured us this session with some details of the specimens of this great ox in the Anatomical Museum of the University, I have thought it might interest the members if I produced my old notes on the subject.

There are three specimens of these crania of the *Bos primigenius* in the Museum of the Society, marked Nos. 2, 4, and 5 of the "Fossil Skulls," &c., in the printed Catalogue of the Museum, and the following table gives some of their measurements:—

| | 2. | | 4. | | 5. | |
|---|---|---|---|---|---|---|
| | Ft. | In. | Ft. | In. | Ft. | In. |
| Length of skull from supra occipital ridge to front of intermaxillary bones, . . | Intermaxillary bone awanting. | | ... | | 2 | 3 |
| Length from do. to upper part of nasal bones, . . . | 1 | 1 | 1 | 1½ | 1 | 2½ |
| Length from middle of supra-occipital ridge to upper part of orbit, . . . . | 1 | 0 | 1 · | 1 | 1 | 0 |
| Length of orbit, . . . | 0 | 3 | 0 | 3 | 0 | 3 |
| Breadth of do. . . . | 0 | 2¾ | 0 | 3 | 0 | 3 |
| Breadth of skull between roots of horn-cores, . . . | 0 | 10 | 0 | 10 | 0 | 10½ |
| Breadth across middle of orbits, | 0 | 11 | 0 | 11½ | 0 | 11 |
| Horn-cores—circumference of at base, . . . . . | 1 | 3½ | 1 | 2½ | 1 | 0½ |
| Length, following outer curvature, | 2 | 5 | 2 | 4½ | 1 | 10½ |
| Span of horn-cores from tip to tip, | 2 | 10½ | 2 | 7½ | 2 | 2½ |
| Across greatest width of horn-cores, | 3 | 2 | 3 | 1½ | 2 | 7 |
| Length of alveolar sockets for teeth, . . . . . | 0 | 7 | ... | | 0 | 6 |
| Breadth across occipital condyles, | 0 | 6 | ... | | 0 | 5 |

The cranium No. 4 was the one first presented to the Museum of the Society, by the Rev. Thomas Robertson, minister of Selkirk, in 1781. The donation was made through a Mr Cairncross, and the following letter accompanying it is preserved in the library of the Society:—

think it worth while to trouble you with them. If anything deserving the attention of your Society occurs in this part of the country, I shall assuredly transmit it to you. Mrs Robertson joins me in best compliments to Mrs Cairncross and the family—with, dear Sir, your humble servant,—THOMAS ROBERTSON.—*First Letter-book of Soc. Ant. Scot.*, p. 628.

The skull was presented to the Society at its meeting on the 17th July 1781; and the following reference to it is recorded in the Minute-book, vol. i., p. 72:—

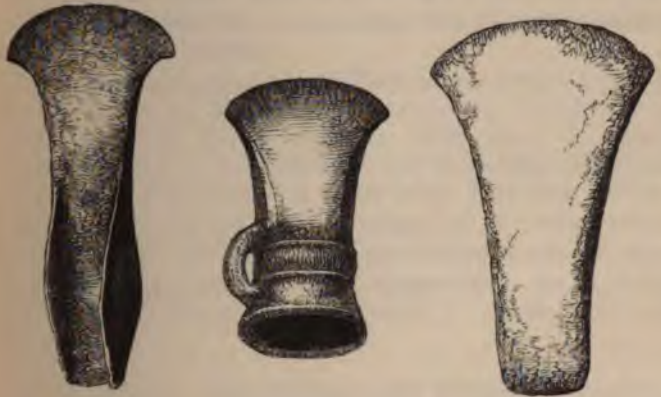
"Mr George Cairncross presented, from the Rev. Thomas Robertson of Selkirk, the bones of the head and flints of the horns of a large animal dug out of a marle-pit near Selkirk, at a place called Whitmuirhall. The circumference of each flint at the base is 14½ inches; the length of that on the right 27 inches, of the other 28 inches; the distance between the sockets of the eyes 11½ inches; the breadth of the front, which is quite flat, from the sides immediately over the sockets of the eyes, 12¾ inches; the depth from the top of the front to the top of the sockets of the eyes, 10 inches; and from the top of the front to the upper part of the insertion of the cartilage of the nose 13 inches. This appears to be the animal described by Julius Cæsar in his "Commentaries," Book vi. c. 5, by the name of *Urus*." And the Secretary, Mr James Cumming, in a letter dated 25th July, informs the Rev. Mr Robertson that the skull was presented to the Society, and "in the opinion of some able naturalists among us, it is believed to belong to that species of animal described by Julius Cæsar in his 'Commentaries,' Lib. vi. c. 5, by the name of *Urus*."

The cranium No. 2 is tolerably entire, but, like all the others, the lower jaw is awanting. It was dug out of a moss in the county of Galloway, and was presented to the Museum of the Society by the Rev. David M'Robert, in the year 1782. In this cranium two of the molars remain in the alveolar sockets. It is referred to in the Minute-book, p. 205, July 12, 1782, as follows:—

"There was presented, from the Rev. David M'Robert, the skeleton of the head and flints of the horns of a large animal dug out of a moss in the county of Galloway, similar in species to the one described in page 72, paragr. ult., and nearly of the same dimensions; the whole length of the front measuring 2 feet 2 inches; two of the *Dentes molares* remaining in the upper jaw, each having one deep furrow in the middle, and measuring on the under surface 1¼ inch the one way, and ⅞ of an inch the other." No letter relating to this skull seems to have been preserved, as, unfortunately, a gap occurs in the letter-books at this period; and from the same reason we learn nothing of the last specimen presented, No. 3, except what is stated in the Minute-book, July 9th, 1782, p. 220:—"There was presented from Thomas Scott of Hapsburn, Esq., the skeleton of the head and flints of the horns of a large animal similar in species to the one described in page 72, par. ult., and in page 205, paragr. 4, and nearly of the same dimensions, but more entire than either; the whole length of the front measuring 2 feet 4 inches, four of the *Dentes molares* remaining in each side of the upper jaw, of the same size and shape with those in the head described in page 205."

As far as I am aware, these are the earliest instances on record of this large-sized ox being observed in Scotland, and it is interesting to find the conclusions come to in regard to them by the naturalists of this generation forestalled by a small body of quiet students of the Antiquities and Natural History of Scotland meeting in Edinburgh so early as 1781;

these large cattle. Unfortunately he considered these axes as of very little consequence, from some supposed similarity to the tools of coppersmiths, though what work coppersmiths could have had to do in the wilds of Selkirkshire, so as to have left their axes lying about in such numbers, it is not very easy to understand. He apparently mistook the nature of these weapons, which were in all likelihood the ordinary bronze axe-heads or celts, now so well known as having been the weapons and tools of the early races who inhabited the British Isles, and which have been found over the whole country, as well as in the stone cists the tombs of the ancient people. I exhibit various specimens of these bronze celts, palstaves, and socketed celts, which, I doubt not, correspond to the coppersmith's axes of the letter referred to. The accompanying woodcut shows various types of these axes.



It has been stated, that bones of the *Bos primigenius* have been found indented with the primitive stone javelin of the aborigines of the north of Europe; here we apparently have them in close relation to the bronze weapons of a possibly still later age, showing that these animals roamed in our forests and marshes, and were hunted by the inhabitants of these early times in at least our northern kingdom of Scotland. Professor Owen says, "from the very recent character of the osseous substances in the remains of these cattle, it may be concluded that the *Bos primigenius* maintained its ground longest in Scotland before its final extinction. And Professor Nilssen of Lund believes that the *Bos primigenius* was found in a wild or half-wild state in the forests of central Europe down even to the beginning or middle of the sixteenth century. (See papers on the Extinct and Existing Animals of Scandinavia," in "Annals and Magazine of Natural History," 1849.)

Dr J. A. Smith exhibited the skull of a sheep (a wether) which, from the singular variety in the form of its horns, had been sent by Mr Sanderson, bird-stuffer, George Street. The horns were closely adjoining each other at the base, in the centre of the forehead, as in the buffalo, and from this point they were bent outwards and upwards like those of the ox.

The Society then adjourned to next winter session.

# PROCEEDINGS

OF THE

# ROYAL PHYSICAL SOCIETY.

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## EIGHTY-NINTH SESSION, 1859-60.

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*Wednesday, November* 23, 1859.—ANDREW MURRAY, Esq., President, in the Chair.

Ramsay H. Traquair, Esq., 30 Clarence Street, was elected a member of the Society.

The following donations to the Library were laid on the table, and thanks voted to the donors:—

Proceedings of the Literary and Philosophical Society of Liverpool, for Session 1858-59, No. 13.—From the Society. Canadian Journal, Toronto, Nos. 20, 22, and 23, for 1859.—From the Canadian Institute, Toronto. Journal of the American Geographical and Statistical Society, Nos. 1, 2, 3, January to March 1859. New York.—From the Society. Conservatory Journal (Newspaper), No. 7; Boston, U.S.A.—From the Editor. Recherches Experimentales sur les Effects du Courant Electrique, appliqué au Nerf Grand Sympathique. Par M. Phillippo Comte Linati, et par M. Prime Caggiati, M.D. Parme, 1859.—From the Authors.

ANDREW MURRAY, Esq., President, then delivered the Opening Address, as follows:—

GENTLEMEN,—It is the custom of this, as of most other Societies, to open the business of the session with an address from one of their Presidents; and our rule is that this duty shall be performed by the senior President on the occasion of his retiring from office, it so happening that the terminal period of that office coincides with the commencement of our session. The term for which I was elected President now draws to a close; I am about to lay down the honour with which you invested me; and the duty of addressing you on the present occasion therefore devolves upon me. The occasion, although an opening one as regards you, being thus a closing one as regards me, naturally suggests that the subject of my address should be of a retrospective nature; and so it has usually been considered by my predecessors in this office. The kind of retrospection, however, which of late years has formed the subject of their addresses, has, alas! almost exclusively been the funeral orations of eminent members removed from us by death during the previous year. Year after year death has gone on picking one by one the best (though not always the ripest) fruit from among us. One year it was Edward Forbes; the next year it was Hugh Miller; the year after, Dr Fleming; and it was clear that no President would have well fulfilled his duty who, in his address, had passed over the deaths of such eminent members of our body without a suitable record and eloge. Owing to the importance of these losses, this species of retrospection has necessarily been prevented from falling into arrear. And now, when, thanks be to God, we have had a momentary respite, and have passed over another year without having such another limb lopped off, the President of the day can turn to another kind of retrospection, which has fallen into arrear, or, I should rather say, which has never, since the revival of the Society, been begun to be brought up. Not that we have no losses during the past year to deplore, but that those which have been sustained are of members who, however able and regretted by us all, have not occupied that space in the public eye, nor ments secured the regard and admiration of the public. The direction in which these have been exercised of late years lay more peculiarly in the walks followed by other societies, which he more frequently honoured by his presence and valuable contributions, and by them his loss will be more severely felt, and from them we may look more fittingly for a narration of his life and labours. To them I will leave it then, and at once proceed with what I was about to say regarding a summary or view of the progress made during the previous year or years in the sciences cultivated by the Society. The desirableness of such periodical reviews or reports will not be disputed; and the general persuasion entertained of their value is sufficiently indicated by three-fourths of the annual Presidential addresses professedly aiming at giving such reviews. And yet the practical results of such attempts are far less satisfactory than might be expected. The student of any department of science might naturally expect that, by referring to an address of this nature, he would find a *resumé* or abridgment of the most important work that had been done in that department during the previous year. But he will generally find himself disappointed; he will find references to such proceedings and discoveries as he already knows, but seldom to much beyond this. And the reason of it is this: the scope of the address is usually too wide; it embraces too much; and as the writer cannot omit notice of the main discoveries which have been the ornament of the year, by the time he has gone over these his space is exhausted, and more minute details are impossible. It is only in societies having a very restricted, single, and direct object, that it can be possible to give a comprehensive summary of all the progress made during the past year. In a society embracing so many, so large, and so well-laboured fields as this does, it would obviously be impossible to compress into a single address (even supposing any one individual were competent to do so), a full or satisfactory *resumé* of the progress of the sciences in which we are interested during any one year. It has, however, been suggested to me by our excellent Secretary, that a less ambitious attempt might be more within reach of success; and that, by restricting the field of operations, a more useful, in so far as a more complete, review might be given. In this Society, although we are all bound by a common bond of union, and all feel an interest in every one of the departments of science which are treated of here, we are not equally proficient in them all. Each has usually some particular branch of our common study in which he feels a greater interest than in the rest. Each has made greater progress in the knowledge of some one special department; and without in any way depreciating the extent and the value of his general knowledge of the whole, each is undoubtedly better qualified to give a review or summary of the progress of that branch with which he is himself most familiar. It has been suggested to me, then, that if those of our Presidents who in their address should wish to cast a retrospective glance over the progress of science were to confine themselves to a report upon the branch with which they are most familiar, we should in the course of a few years have a series of summaries which might be really practically useful to the student—at all events, more so than any merely general retrospects could possibly be. In my present address I propose to act upon this principle; and taking that branch of science, Entomology, which is my favourite department, and that branch of it (Coleoptera) which I specially affect, I shall endeavour to lay before you a view of what has recently been done in this science, both at home and abroad:—

Beginning with the works on systematic entomology published during the last three years or so, *facile princeps*, whether in extent and import-treatise, embodying at their proper places the thousands of independent notices scattered through a crowd of transactions and periodicals—disposing of questions of disputed synonymy—deciding the great questions of disputed arrangement, and where these appear wrong correcting them, or offering a new solution of the difficulty,—is a task requiring the patience of Sisyphus and the powers of labour of Hercules, combined with talents, attainments, and facilities possessed by very few. Such is the task which is now being successfully carried out by Professor Lacordaire. Five volumes have already appeared: the first is occupied with the *Carabidæ;* the second, the *Staphylinidæ* and *Claricornes;* the third, the *Lamellicornes;* the fourth, the *Buprestidæ, Elateridæ,* and *Malacodermata;* and the fifth, with the *Heteromera.* The manner in which a systematic view of the subject is given is this:—The characters of the different groups, larger and smaller, are separately detailed; a full exposition of the characters of each genus, with its synonymy, is then separately given; a notice of its geographical distribution, or any specialty relating to it, is added; and in a note, a list of all the species hitherto described is given in the shortest space possible, with occasional synonymical corrections. A beautiful atlas or volume of plates, giving figures and details of the rarer genera, is to accompany the work; and here, as in the text, every care is taken to save unnecessary expense. In the lists of the species given in the notes, for instance, instead of burdening them with the species which have been described in the chief monographs on the subject, Professor Lacordaire assumes that these are already in the library of every entomologist, and merely says, "To the 150 species (or whatever the number may be) described by Dejean, add the following." So in the plates, nothing that is to be found in works easily accessible is here repeated. This has been carried so far as even to assume the aspect of a defect—at least I am sure that the majority of purchasers would gladly have paid a little more for a larger series of figures of rare genera than has yet been given. The result of Professor Lacordaire's labours, however, is that this is undoubtedly the most useful entomological work of the present day. It is a perfect storehouse of information, and forms a new starting-point from which entomologists may take a fresh departure. In according to it so much commendation, I am far from implying that it is perfect, or implicitly to be trusted to. It is *ex necessitate* in great part a compilation, and, as in all compilations, the accuracy of the work depends upon the accuracy of the original describer, not of the compiler.

Next in importance to this work of Professor Lacordaire we have a number of very valuable monographs. The concurrent opinion of entomologists has been of late years expressed so strongly against the practice, once common, of giving isolated specific descriptions of individual insects in transactions or periodicals, that such descriptions are now becoming proscribed, unless where some special reason exists for signalizing an individual—as, for instance, its being of a very anomalous character, so that its true position may be matter of doubt, or its supplying a vacant gap, or furnishing an interesting unknown representative in one country of a group peculiar to another country. Except under such circumstances, one does not now often meet those isolated descriptions with which the young beginner used to essay his flight. Something connected is now looked for, and entomological writings either assume the form of monographs or local faunas. I shall first glance at the recent monographs. One very important one is a monograph of the *Elateridæ* by M. Candeze of Liege (a pupil of M. Lacordaire), which has been executed with a care and skill worthy of his great master. M. l'Abbé de Marseuil's monograph of the *Histeridæ,* lately published in the *Annales* of the Entomological Society of France, is another most admirable specimen of what a monograph should be. In addition to a good description, an engraved outline of every species is given—an assistance which those who have puzzled over the great number of species apparently alike, and only distinguished by their delicate sculpturing and punctuation, will know how to appreciate.

Another important monograph has been brought to a close within the last three years—Boheman's *Monographia Cassididarum.* The first volume has been before the public for some years; the second is now also, and the favourable verdict which had been pronounced upon the first is confirmed on the second. So many additional species have since been discovered, that he informs me that a supplement has become necessary, and will be published.

Two other monographs have appeared or been commenced upon other families of the subpentamerous *Phytophages.* One a monograph upon the African *Cryptocephali*, published by M. Suffrian in the *Linnea Entomologica* two years ago. M. Suffrian had previously monographed the *Cryptocephalidæ* of Europe, and also those of North America. He is now engaged upon those of Australia, to which, although Mr Wilson Saunders' papers in the 4th volume of the *Transactions of the Entomological Society of London* formed a valuable contribution, much still remained to be done.

The other monograph lately published, in this group of families, is the Catalogue of the *Hispidæ* in the British Museum, by Dr Baly—first volume. In accordance with the enlightened course followed by Dr Gray in publishing lists of the contents of the British Museum, these, from originally consisting of a mere list of what was in the museum, have gone on improving, first into a list both of described species already in the museum, and of the desiderata not in the museum; then advancing into a description of new species in the museum besides those already described; and at last assuming the form of perfect monographs by the first authorities, containing their newest views of arrangement, the descriptions of species both old and new, and this not merely the new in the museum, but all the new that can be collected from every quarter; so that, while practically the interest of the museum in it is limited to the letters B. M. appended to the species it possesses, its real interest extends to the whole scientific world. Dr Baly's work is the production of a careful and acute naturalist, and is a credit to the science of this country.

been carefully and conscientiously investigated, and that the conclusions to which they had come were to be relied upon. One fortunate accidental circumstance in that case prevented the embroilment of synonymy becoming so great as it would otherwise have been: Kirby, instead of giving separate generic or subgeneric names to his minor sections, indicated them merely by a greater or less number of asterisks or Greek letters, so that the generic names which had been given them by Latreille stood and answered both for his own sections and for those of Kirby. In this instance the same coincidence does not occur. Gerstacker has taken his generic characters chiefly from the parts of the mouth; Guerin-Meneville from the elytra, the legs, and the prosternum—which latter, however, has also been made use of by Gerstacker; but fortunately, before Gerstacker's work issued from the press, he had the opportunity of seeing Guerin's papers, and he points out the differences between them in an appendix.

Some other valuable monographs have appeared in various periodicals, or in occasional works which are issued by one or two zealous entomologists—in the *Opuscules* of Mulsant, the *Archives* of Thomson of Paris, and the *Etudes Entomologiques* of Motschoulsky, &c., &c. In his *Opuscules*, Mulsant has published several valuable monographical papers, contributions to the history of the *Pediniteæ*, and others of the *Heteromera*. M. Motschoulsky has given a monograph of the *Lampyridæ* or glow-worms, and of the *Malacodermata*, in his *Etudes*. Mr Thomson is publishing a monograph of the *Cicindelidæ*, with coloured figures of every species, in a style of "*luxe*" (we have no word which expresses the meaning so well) hitherto unequalled. He has also, with equal magnificence, in his *Archives*, monographed the *Anacoli*, *Tragocephali*, &c., limited but beautiful tribes of *Longicornes*. Several lesser monographs have also lately appeared, such as that of M. Bouldieu on the *Ptini* (*Ann. Soc. Ent. Fr.*); and of M. De Bonvouloir on the *Throscidæ*, &c.

Let us now turn to the special additions to our knowledge of insects and of their geographical distribution. We naturally turn our eyes first to our native country, and inquire what advance British Entomology has been making. From various causes, the zeal of our entomologists has of late chiefly taken the direction of the *Lepidoptera*. Mr Stainton, by his personal energy, as well as by his work on the *Tineina*, has given a great impulse to the study of the *Microlepidoptera*; and his *Entomologist's Annual*, which has been the chief outlet to the votaries of British Entomology, has naturally been principally occupied with the department which its editor most affects. Mr Jansen, however, in that annual has done good service to the *Coleoptera*, by placing upon record the capture of such species as were not previously known to be British—or rather, not recorded in Stephens' *Manual* as British. This record of additions, which is prepared with much care, comes at a most suitable time to aid Mr Waterhouse in his unpretending but most laborious construction of a catalogue of all the British species of *Coleoptera*. As this is not merely a catalogue of all Stephens' species, with the addition of such novelties as Mr Jansen and others may have recorded, but a careful examination of every specimen in Stephens' collection, and an unravelling and comparison with continental names of his and Kirby's synonymes, so as to give us a true list of what is really native (no doubtful species being admitted), it is obvious that it is a work which could only be undertaken by a consummate entomologist. He has published about the half of it; and as, for the sake of certainty and harmony with the continental nomenclature in such difficult families as the *Staphylinidæ* and *Nitidulidæ*, he has expressly visited the continental collections, so as to see the true types of Erichson and others, we have a work of European value. I can truly say, that there is no work falling within my present subject which comprises so much skilled labour in such small space. This catalogue is the first step towards our procuring a good manual or entomological work in the English language, giving descriptions of the species found in Britain. Members are aware that we have no such work, and that at present, for good working books of reference, we must have recourse to the Continent, although even there they are not far ahead of us, no good work on the subject having been yet completed, although some are in progress. The British works which we do possess are Curtis's *British Entomology*, Wilson and Duncan's *Entomologia Edinensis*, and Stephens' *Illustrations* and *Manual*. Of these, Curtis's *British Entomology* gives a valuable series of coloured plates, which are so judiciously selected as to represent almost every one of our modern genera. The text is certainly not equal to the plates, and I do not think that Mr Curtis would now so consider it himself. Entomological descriptions are very different things from what they were when he wrote that work. The arrangement also is confused, owing to the plan adopted—bringing out the work in parts containing a little of each department at the same time, or nearly so; and the work generally would require to be revised to suit the modern state of the science. The plates, however, are unsurpassed: they have been published separately, and other use will yet be made of them. In the meantime they give what is equivalent to the genera of most of our British insects, and that not only in the *Coleoptera*, but in all the other orders. The book, however, is out of print, and, besides, was so expensive as to put it beyond general reach. There is now an equivalent to this book publishing in Paris, so far as the *Coleoptera* are concerned. It is styled the *Genera des Coléoptères d'Europe*, by M. Jacquelin du Val, a very accurate entomologist, who first distinguished himself, some years ago, by publishing a revision of that most perplexing family, the *Bembidia* of Europe. His present work gives a beautiful coloured figure, with details, of every genus known in Europe. The other English works capable of assisting him in this object are the *Entomologia Edinensis*, by the late Mr James Wilson and Mr W. Duncan, applicable only to a small portion of British species, and, moreover, out of print. Stephens' *Illustrations* and *Manual*, although of the highest value when they first appeared, are now felt to be so cumbered with blunders and inaccuracies, that many think it better not to use them at all. A few more monographs of British species of certain groups, which are everything that one could wish, so far as they go, but only embrace a small part of respects so similar to our own, that any new discoveries in Britain may be reasonably expected to be species already known there; and we thus have not only a most careful guide to the species already known in Europe, but the means of deciphering any novelties. There is another book of a similar nature which would be very useful to British entomologists, but is in a manner superseded by the two preceding works—a series of volumes, by M. Mulsant, descriptive of different sections of Coleoptera in France. It is a good many years since he published the *Lamellicornes* of France, the *Palpicornes* of France, the *Longicornes* of France, the *Securipalpes* of France, and now we have the *Heteromera* of France in progress. Every one must admit the value of M. Mulsant's works; but their extreme minuteness of description renders them less popular than they deserve.

So far as regards the European fauna, a great many additions can scarcely be expected. A number of new species from the Llandes and the Pyrenees have been described by M. von Kiesenwetter and others; and some interesting small species, constituting new genera, have been discovered by M. Jac. du Val, near Montpelier, and described in his *Genera des Coleopteres.* Spain has done a little by the hands of Professor Graells of Madrid, and Dr Rosenhauer of Erlangen has described some new species from Andalusia. But the chief novelties of interest have been drawn from two sources not thought of till of late years—namely, ants' nests and subterranean grottoes; the additions drawn from the former source have been chiefly *Staphylinidæ*, and will be found in a paper by M. Kraatz upon the *Termitophila* (both those in the nests of termites and ants) published in the *Linnea Entomologica* last year. The *Troglodytes* or subterranean families have produced several interesting new eyeless species, and one or two genera. The most interesting points are the fact, that every new cave, or cave-district, produces not the old previously known cave-animals, but new species, peculiar to itself. A curious blind new genus, *Leptomastax hypogeus*, has been found on the sands of the Bay of Besika, near Constantinople, and described first by M. Pirazzoli, and afterwards by M. Leon Fairmaire. It is peculiarly formed, allied to the *Scydmænidæ*, and has no affinity to any of the cave-insects we have yet seen, but has considerable resemblance to a small ant; and although found at large, as it were, I have no doubt it is an ant's-nest species, and will yet be found in its proper residence.

Few new additions have been made to the fauna of the north of Europe. Prince Napoleon's expedition appears only to have produced one new species, described by Reiche under the name of *Patrobus Napoleonis;* but a good deal of useful geographical material relating to that quarter will be found in two papers by Maklin and Osten-Sacken, published in 1857 in the *Stettiner Ent. Zeitung*, which continues to go on prospering, and I trust long to prosper, under the able headship of its perpetual president Herr Dohrn (one of our foreign members), and nowise injured by the rise of its newly established formidable rival the *Berliner Entomol. Zeitschrift*, in which are to be found some very valuable papers. Among the more important original papers which have appeared in this Journal falls here to be mentioned a fauna of the Coleoptera of Greece, by Dr Kraatz and M. von Kiesenwetter.

Many Russian and Siberian species have been described by Count Motschoulsky in his *Etudes Entomologiques*, and the *Bulletins of the Imperial Society of Moscow.* A considerable number of species taken during the Crimean war, in the Dobrudska, Crimea, and other shores of the Black Sea, have been described in the *Annales of the Entomological Society of France*, and elsewhere. The Baron Chaudoir continues to enlarge our knowledge of the Caucasian and Mingrelian regions; and

M. Kolenati, in his *Meletemata*, has also contributed to our knowledge of this district.

Passing round into Africa by the shores of the Mediterranean, we have received from Messrs Reiche and Saulcy a considerable addition to our knowledge of the entomology of Palestine, a district of which we knew comparatively little. The materials from which this contribution has been derived were collected during the expedition by M. de Saulcy, who, the Society may recollect, published an interesting account of his visit to the Dead Sea a few years ago.

Continuing our course round the Mediterranean, we find in Count Motschoulsky's *Études Entomologiques* the description of a number of the minuter Egyptian species overlooked by previous explorers. M. de Motschoulsky has extended his travels into a good many districts both in the Old and New World; and, as he is an assiduous collector as well as a rapid describer (too rapid, most entomologists think), we have a good many species from his pen from all parts of the world.

Continuing along the north coast of Africa, a number of new species from Algeria have been described by M. Lucas; but this applies less to the Coleoptera than to some of the other orders. Madeira should come in here. Mr Wollaston has published in the form of a catalogue, consisting of a complete series of the species of Madeiran Coleoptera in the British Museum, presented by him to that institution, a number of new species detected since the publication of his great work on the *Insecta Maderensia*. He returned last summer, with an immense amount of materials for a fauna of the Canary Isles; but I grieve to say that his state of health has been too bad to allow of his putting them into shape.

Little new has been recorded on the west coast of Africa until we come to Old Calabar. My descriptions of new species from that district, which by a sort of legal fiction have been read here, have gone on appearing in the *Annals of Natural History* from time to time, as suited my own convenience. M. Chevrolat, to whom I confided the Longicornes, published a century of new species, among which are some of singular beauty. Dr Baly has also described some of the new genera of *Phytophages* in the *Annals of Natural History*.

Possibly, stimulated by the number of novelties sent home by our friends in Old Calabar, and distributed among continental entomologists, two eminent entomologists resident in Paris, Count Mnizscheck and but there was no general systematic work until Prof. Boheman, of Stockholm, four or five years ago, commenced his *Insecta Caffraria.* The first volume was then published; and the second, containing the *Lamellicornes*, has appeared during the last year. Like all Boheman's works, this is most satisfactory. I find a general impression among working entomologists, that Boheman's descriptions come nearer to what an entomological description should be, not only in acuteness and discrimination, but also in attaining the proper medium, in point of length, than those of almost any other living entomologist.

Madagascar stands blank. Nothing has been done to it during the period I am reviewing, either in the way of collecting or describing, unless we reckon as something the unsuccessful attempt of Madame Pfeiffer. The cruelty and atrocity of the queen have made it forbidden ground, and it is like to continue so, at all events during her life, unless some fortunate political squabble with some of our ships shall rouse our Government to interference, or a lack of other openings shall tempt some of our missionaries to that wondrous land.

Signor Bertolini has supplied the collections of Europe with a fair sample of the productions of Mozambique, and has also given descriptions of the most striking.

Passing Abyssinia, the Red Sea, Arabia, Persia, and the Himalayas, which have produced little or nothing new during the last few years, we shall find that a good deal has been done in India, more especially in its southern portion and Ceylon. M. Nietner has discovered and described a good many new species from Ceylon, particularly a number of minute species generally overlooked. Count Motschoulsky, in his last two years' *Études Entomologiques*, has also described a great many minute species, some of them of very singular and abnormal appearance. A very considerable number of species of Coleoptera from Ceylon have also been described in the *Annals of Natural History*, during the last year, by Mr Francis Walker, well known for his papers on the *Chalcidites;* for his two volumes on British Diptera (*Insecta Britannica*); and for his Catalogues of Moths in the British Museum. Unfortunately, Mr Walker has sacrificed everything to shortness, so that, without their apology, his descriptions, so far as regards decipherableness, must rank with those of Linnæus and Fabricius. Nagpore has its name, which was already distinguished in natural science, rendered still more so during the last few years through the exertions of two Scottish missionaries, our friends Mr Hislop and Mr Hunter. It is chiefly to geology that their studies have been directed, and they have brought home with them a number of fossil parts of insects, which, through their kindness, were placed in my hands for examination and description. These, so far as they were in a condition to allow of its being done, I described in a paper which formed part of Mr Hislop's general geological work, now in course of publication by the Geological Society of London. The materials were too few and imperfect to generalize from; but they all belonged to the great families still common on the Indian continent—*Buprestidæ*, *Curculionidæ*, &c. The structure, however, of some of them seemed to have more affinity with certain modern Australian forms. This, however, rests on a mere hazy resemblance, insufficient to warrant reliable deductions. The arrivals of species from China, Hongkong, Singapore, Java, &c., have been few of late years, and the descriptions of new species still fewer, being limited to a few isolated species, described for their beauty, such as *Carabus Fiduciarus*, *Carabus Cœlestis*, &c., and a few *Phytophaga*, occasionally described by Dr Baly.

M. Motschoulsky, however, has given us the descriptions of a number of species picked up at the mouth of the Amoor and in Japan by M. Gaskevitch, probably the same person who I see announced in the papers as Russian Consul-general, under the name of Gorkwitch, who accompanied the Russian admiral, Pontiatine, as naturalist, in his visit to Japan, when the treaty with that kingdom was entered into. M. Gaskevitch was wrecked in the Russian frigate Diana, in consequence of a terrible earthquake, and kindly treated by the Japanese, who subsisted the shipwrecked crew. Thereafter, in an attempt to rejoin the Admiral in a Russian ship, he was captured by the British, and his scientific career in these seas closed for the time by his having been sent home to be adjudged upon in this country; where he no sooner arrived than he was at once ordered to be set at liberty. He does not seem to have liked his captivity at all, and I am sure men of science in this country will like it as little. How any captain could have conceived it consistent with his duty to arrest a scientific man in his career of usefulness, under any circumstances, seems difficult to understand; but there are always two sides to a story—and *audi alteram partem* is a rule never deviated from without subsequent unpleasant reflections. If he has now returned to fill the important part of Consul-general, we may expect to reap a good harvest of Coleoptera through his friend Count Motschoulsky.

From the loss of his collections, sustained by M. Gaskevitch, the report and descriptions of the Japan and Amoor species are very meagre, chiefly Lepidoptera. Of the Coleoptera brought by him, M. Motschoulsky remarks that they offered little resemblance to our European species, and that there were only found three which appear identical with those of the west—*Anomala oblonga*, *Anobium paniceum*, and *Coccinella impustulata.* All the rest belonged to the type of China and the Philippine Isles.

If we have drawn little from the north of these seas of late years, the more southern portion has amply atoned for it; Mr Wallace having sent from Celebs, Aru, &c., a great variety of most beautiful and striking new species. These, for the most part, yet remain to be described; only a few of their favourite group, the Longicornes, having been described by Mr Pascoe in the *Transactions of the Entomological Society of London*; and by Mr Adam White, in the *Proceedings of the Zoological Society of London.* I hope we shall have many more of these species described by these gentlemen.

There has been an intermission to the rapidity with which the entomology of Australia and New Zealand was becoming known. Dr Baly's and a good many of the new species brought to this country by M. Chabrillac have been described by Fairmaire and others in the *Transactions of the Entomological Society of France.* The contributions to the entomology of the Andes, in the neighbourhood of Quito, sent to this country by our correspondent Professor Jameson, have been partially recorded by Dr Baly and myself, and a number of small species from Panama have been described by Count Motschoulsky.

Dr Leconte, a worthy son of a worthy sire, has taken entire possession of North America. He is the chief, indeed almost the only, entomological author now working in America; but he is a host in himself. He has reviewed most of the difficult families in the United States; his revisions, in fact, being singularly able monographs, evolving the most original views. He has thus gone over the *Cicindelidæ*, *Carabidæ*, including the *Amaræ* and *Bembidia*, the *Hydrocantharidæ*, the *Palpicornes*, the *Buprestidæ*, the *Elateridæ*, the *Lamellicornes*, and the *Longicornes* of North America. He has, along with Dr Harris and Melsheimer, brought out the catalogue of species of Coleoptera in the United States, and has lent his hand in every quarter of the States to the advancement of zoological knowledge. I am here restricted to speaking of his doings in relation to the Coleoptera; but, were the time fitting, I might enlarge on his services in regard to almost every class of animals, from the Vertebrata downwards. In the Coleoptera, at an early period, we have from his pen descriptions of numerous species from California; we have descriptions of species from Texas; we have descriptions of species from Lake Superior—part of the report by Agassiz on that district; we have descriptions of species collected during the expedition sent to report upon the routes proposed for the railway across the Isthmus of Panama—many the product of his own collections, for I believe his labours as a field entomologist are not less than his talents and acumen as a closet naturalist. All this work has been done within the last few years, and it is still going on. We may hail Dr Leconte as one of the first living entomologists; and when we remember how comparatively scant a sympathy he has in his own country, the homage we pay him will only be the more hearty. Thanks to the Smithsonian Institution, we shall have most of Dr Leconte's works in our library.

A portion of North America, possessing special interest from its resemblance to a part of the opposite continent of Asia—I mean the Salt Lake region as compared with the Caspian district—has lately been somewhat opened. M. Lorquin, an able French entomologist, has made collections in that district, and they have reached Paris, and are in the hands of M. Boisduval, the lepidopterist. It is the Lepidoptera to which he chiefly restricts himself, and it is to them he specially refers in a notice of the collection given by him to the Entomological Society of France. He says, "Among these insects, many, although specifically new, have the aspect of those of the mountains of Europe, and especially of Siberia; several even are identical with some of our species."

Dr Asa Fitch, chiefly known as a zealous hemipterist, has lately brought out, under the auspices of the State Government of Pennsylvania, a work on the noxious insects of that State; among which the habits of some Coleoptera are described. The care, accuracy, and perseverance shown in this work are very remarkable.

Such is a hasty and imperfect account of what has been doing in the science of Entomology (department Coleoptera) for the last three years; for its imperfections I now crave your apology. Imperfect, however, as it is, I think the impression which it must leave upon our minds is one of awe and amazement at the inexhaustible prolificness of Nature, and something also of admiration for the courage with which puny Man has set himself to the apparently interminable task of deciphering and recording such a towering pile of indigest materials.

The thanks of the Society were unanimously voted to Mr Murray for his services as President, and for his interesting and valuable address.

The following Communications were then read:—

### I. *Report of the Committee on Marine Zoology (with special reference to the presence of the Whitebait* (Clupea alba) *in the Firth of Forth).* By George Logan, Esq., W.S., Convener.

Mr George Logan read a report from the Committee on Marine Zoology, which, after a detail of the general proceedings of the committee for the past season, stated that, in sweeping the beach near Seafield with a small Seine net, during the months of August and September, whitebait (*Clupea alba*) had been taken in considerable quantity; that specimens so caught had been closely compared with the sprat or garvey (*Clupea sprattus*), and with the herring (*Clupea harengus*), and the distinctive markings coincided in every respect with those stated by Dr Parnell in his article on the Ichthyology of the Firth of Forth, published in the "Magazine of Zoology and Botany" in 1837; and that, further, the assertion of Parnell was confirmed—correcting the statement of Yarrell to the contrary—that the tongue, and roof of the mouth of the whitebait are furnished with teeth. Specimens of the three species of Clupea were exhibited, and even a tion that the whitebait of Parnell and Yarrell existed at present in the Firth of Forth, in many localities in great abundance; and that, if properly fished with suitable apparatus, it would probably be found very generally distributed in the estuary. The reporter added, that when sweeping with the net in an east wind, or any wind blowing upon the shore, no whitebait appeared; and that, on the contrary, during the prevalence of winds from the shore, they were always present. A marked peculiarity was observed in regard to the herring, which was absent in the whitebait and sprat, viz. a constant effusion of blood from the mouth and gills, and this occurred without fail in hundreds of specimens examined.

In reference to this report, Dr M'Bain and Mr Bryson remarked that much credit was due to Professor Dick in calling the attention of the public to the large supply of whitebait to be obtained on the coast near Kinghorn and Burntisland; and through the energy of the Professor, nets had been obtained and premiums had been offered for the encouragement of the Fishery.

### II. *A Specimen of the Canada Goose* (Anser Canadensis), *shot on Duddingston Loch*, was exhibited by R. F. Logan, Esq.

This bird was quite perfect, without artificial marks of any description, and was watchful and wary, remaining always about the middle of the lake. It was of large size.

### III. *Extracts of Letters from Dr Livingstone's Expedition to the River Zambesi, Africa.* By Alexander Bryson, Esq.

Mr Alexander Bryson read extracts from letters received from Dr Livingstone and other officers of the Zambesi expedition by a friend in Glasgow, describing the valley of the "Shire," and giving some particulars of the natives, besides stating that the steamer which had been sent from Liverpool had turned out a complete failure in every respect; but the information contained in these letters is in substance the same as that which appeared in the report of the meetings of the Royal Geographical Society of London. In a note to one of the letters Dr Livingstone says: "A Mr Wilson of Glasgow served us most conscientiously with provisions; everything was of first-rate quality, and I should feel pleased if you would thank him for me. Wilson is a good fellow, whoever he is, and I would not go by him on any account on another occasion." Mr Bryson remarked, that had Franklin's expedition been supplied by such a purveyor, in all human probability they would have been spared, as it was now proved beyond doubt that their lives were sacrificed by the accursed cupidity of the contractors, who supplied them with putrid provisions. Mr Bryson concluded by moving that a memorial to the Lords of the Treasury be prepared, urging the Government to send a more suitable vessel to the Zambesi, which was unanimously agreed to.

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*Wednesday*, *25th January* 1860.—William Rhind, Esq., President, in the Chair.

The following gentlemen were elected the Office-bearers for the Session 1859–60:—

*Presidents*—William Rhind, Esq., Thomas Strethill Wright, M.D., Alex. Bryson, Esq.

*Council*—George Logan, Esq., W.S., Professor Balfour, James M'Bain, M.D., R.N., John Coldstream, M.D., Andrew Murray, Esq., John Cleland, M.D.

*Secretary*—John Alexander Smith, M.D.

rts and Manufactures, 1856, 3 vols.; Agriculture, 1856, 1 vol.—From he United States Patent Office. Smithsonian Report for 1857; Defence f Dr Gould by the Council of the Dudley Observatory, Albany, 1858. —From the Smithsonian Institution, U.S.A. Reply to Statement of the Trustees of the Dudley Observatory. By B. A. Gould, M.D. Albany, 1859.—From the Author.

### *Memorial to Government on behalf of the Livingstone Expedition.*

**Mr Andrew Murray** reported that in accordance with the resolution of a previous meeting, a memorial had been drawn up and forwarded to the Chancellor of the Exchequer, praying that immediate assistance be granted to the exploring expedition in Africa under the command of Dr Livingstone; and he was glad to state that the assistance required had since been granted by the Government.

The Communications read were as follows :—

### I. *On the Reproduction of a Medusa, belonging to the genus* Lizzia. By Professor EDWARD CLAPARÈDE, Geneva. Communicated by Dr T. STRETHILL WRIGHT.

M. Claparède stated that he had captured, in September last, in Lamlash Bay, a number of floating eggs. On examining these eggs he found in each a true medusa, with four radiating gastrovascular canals, and eight tentacles—four short and four long, the long ones corresponding to the radiating canals. A careful search was rewarded by the discovery of the animal which had produced these eggs, a twelve tentacled medusa of the genus *Lizzia*; the bulbs, which in the embryo gave rise to the longer tentacles, being in the adult each furnished with two of these appendages. The peduncle was laden with eggs; of these eggs some exhibited a germinal vesicle and spot, others well-developed medusæ, but in none was the stage of segmentation of the yolk observed. The question was, whether the bodies in question were eggs or buds? It was true that no males of this form of *Lizzia* were found. But the males might be more rare than the females, or, as Dr Strethill Wright had observed in one case, might have a form different from that of the female. The structure of the bodies was that of true eggs. The canals of the medusæ which they contained had no communication with those of the parent, differing in this respect from the canals of the budding medusas of *Sarsia*. The buds of *Sarsia*, moreover, did not exhibit the germinal vesicle and spot. The author stated that the reproduction of medusæ, without the occurrence of a fixed hydroid stage, had been observed by Gegenbaur and Krohn, but in these cases the embroyos had to undergo important alterations in form before presenting the characters of the parent. M. Claparède considered it possible that reproduction in Lizzia might also take place with the intervention of the planuloid and hydroid stages.

Mr A. Murray congratulated the Society on its good fortune in having commenced a correspondence with so distinguished a naturalist as M. Claparède; and proposed that the thanks of the Society should be transmitted to him for his important communication, which was unanimously agreed to.

Dr Strethill Wright considered M. Claparède's paper of the highest importance. Its author, it was true, had not traced the gradual development of the ovum into a medusa, nor had he seen the segmentation of the vitellus, but Dr Wright had convinced himself that in a majority of zoophytes the vitellus never divided; it became minutely granular and opaque without segmentation. Still, some intermediate form might occur even within the egg. The male of this *Lizzia* might differ in form or development from the female, as was the case in the medusoids of *Atractylis* (*Eudendrium*) *ramosa*, and *Campanularia dichotoma* (*Loveni*). It was well known that although in some zoophytes the reproductive apparatus of the male and female was identical in shape, in others the difference was very remarkable.

### II. *Note on an Instantaneous Method of finding Microscopic Objects under High Powers.* By T. Strethill Wright, M.D.

The author stated, that when examining small living organisms under pressure, he had frequently much difficulty in placing them under the higher-powered objectives with sufficient rapidity. The animals often commenced breaking up before they could be found. By adopting the following method of finding objects, he could instantly, and without even looking through the body of the microscope, place in the centre of the field, and in focus, any object which could be barely detected by the naked eye.

The fine adjustment slide was marked by a small scratch on the brass-work, and it was afterwards not used. A speck of paper or other substance, sufficiently large to be just perceptible to the naked eye, was placed in water on a glass slide, covered with thin glass, placed in the centre of the field, and accurately focussed under the high-powered object-glass. The coarse adjustment was then marked by a scratch on the body of the instrument or the slide of the rack ("scratch No. 1"). The operator then placed the point of his nose on the top of last might be changed for some other object. When the microscope was marked as above, an object might instantly be found and focussed at any future time by adjusting the microscope to "scratch No. 2," placing the nose and forehead as described, and the object required to be focussed in the fourth adjusted point, and screwing down the body of the microscope to "scratch No. 1."

The author illustrated his method before the Society, by instantly placing and focussing several small objects under the microscope without looking through the eye-piece.

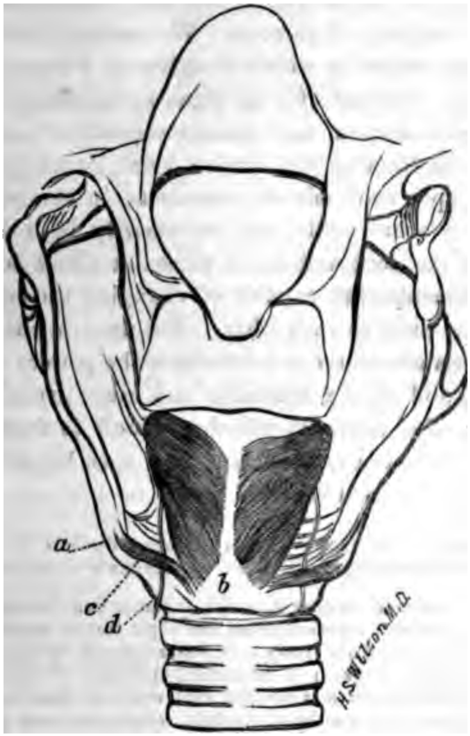
### III. *Remarks on the* Musculus Kerato-Cricoideus, *a Muscle of the Larynx. (Merkel's Muscle).* By WM. TURNER, M.B. (Lond.), M.R.C.S., Senior Demonstrator of Anatomy, University of Edinburgh.

The muscular arrangements of the human body have been, during the last two or three centuries, so thoroughly examined, and carefully described, that it rarely falls to the lot of a modern anatomist to discover, merely by the aid of his unassisted vision, a new muscle. To such a structure, however, the attention of anatomists has been recently directed by Dr Carl Merkel of Leipsic, in an elaborate treatise on the Anatomy and Physiology of the Organs of Voice and Speech (Stimm und Sprach Organs, 1857). In this work he has described a muscular slip occasionally extending between the posterior surface of the cricoid cartilage and the posterior margin of the inferior cornu of the thyroid, and thus forming one of the intrinsic muscles of the larynx. His account of the muscle is as follows:—

"*Musculus Kerato-cricoideus. Horn-Ringknorpelmuskel.* —This small, hitherto undescribed muscle, is not found in every larynx, and when present, it exists only on one side, for which reason I have considered it as one of the unsymmetrical muscles of the larynx. It arises, about 1–1½‴ broad, close to the origin of the outer (or anterior) fibres of the musculus crico-arytenoideus posticus, so that it appears as an additional portion of the same, and probably has been hitherto so regarded by anatomists, or as such overlooked by them. It does not, however, pass upwards with this last muscle, but extends obliquely upwards and outwards, and after a short course is attached to the posterior margin of the inferior horn of the thyroid cartilage. The inferior laryngeal nerve passes under it, and the kerato-cricoid ligament crosses it at nearly a right angle. The entire muscle is about 3–4‴ long. Its action, which certainly cannot be important, is to fix the lower horn backwards and downwards; it opposes in some measure the part of the crico-thyroid muscle connected to the anterior margin of the horn." (Pp. 132, 133.)

My attention having been directed some months ago by Professor Goodsir to this description of Dr Merkel, I have since that time carefully examined the larynx in almost all the subjects received into the dissecting-rooms of the University, and have thus been enabled to supplement the account of Dr Merkel with some additional particulars, as well as to correct an error into which he has fallen. Thirty-two specimens have been dissected by me, and amongst these the muscle existed in seven cases, being in the ratio of 21·8 per cent. In four of these it was on the right side only, in two on the left, and in one on both sides. Thus, the statement of Merkel, that the muscle "exists only on one side," is not absolutely correct; and although it is undoubtedly true as a general rule, yet, like most general rules, it admits of occasional exceptions. I have had a drawing made of the larynx, which was from a male subject, in which this double muscle was found, an engraving of which is here subjoined.

The kerato-cricoid muscle is not confined to the larynx of one sex, as I have found it both in the male and female. The tendinous fibres being found at each of these extremities. The muscle appears to be developed in a direct relation to the other laryngeal muscles, for the largest example I have yet seen occurred in a larynx the muscles of which were unusually well formed, whilst the smallest example was found in a larynx possessing comparatively feeble muscles; at the same time, it must be stated that its existence in a larynx is not necessarily coincident with a general laryngeal muscularity, as I have dissected more than one larynx in which no trace of Merkel's muscle could be found, although the other muscles were extremely well developed. The inferior laryngeal nerve passes under, *i.e.*, in front of, this muscle, and sends a small filament to it. The kerato-cricoideus must thus be classed amongst the occasional muscles of the larynx, and, like other occasional



*a* Inferior cornu of thyroid. *b* Cricoid cartilage. *c* Kerato-cricoid muscle. *d* Inferior laryngeal nerve.

muscles, the psoas parvus for example, it is most frequently found only on one side—either the right or left, as the case may be—the only instance as yet recorded of its existence on both sides being the one above figured.

With regard to its function, it must be evident that it is not essential to the production of the voice, seeing that it is absent in the majority of persons. We cannot, however, doubt that in those cases in which it exists, it determines certain modifications of sound; for an organ so delicately constructed as the human larynx, and sounds capable of such varying modulation as those of the human voice, depending for their production upon such minute alterations in the relative positions of the vocal cords, will necessarily be more or less affected by the contractions of muscular fibres which, from their attachments, are capable of changing the relative position of these cords to each other. But until in the same individual an examination can be made of the powers of the voice during life, and of the muscular and other arrangements of the larynx after death, it will be difficult to determine with any exactness not only the function of this, but also of many of the other laryngeal muscles.

### IV. (1.) *Notice of the Capture of an enormous Cycloid Fish in the Bay of San Francisco, California.* By Andrew Murray, Esq.

This was a notice of an enormous fish taken at San Francisco. It was 360 pounds in weight, between seven and eight feet in length, and 5 feet 2 inches in girth round the body. It was supposed by its captors, who were probably New Yorkers, to be a giant specimen of the sea basse, or were carefully kept in glass-houses. He also made some remarks in support of the recent German theories against the generally received opinions of the igneous origin of granite, and in favour of its aqueous origin.

VII. (1.) *Dr John Alex. Smith exhibited a Specimen of Bloch's Top-knot* (?) (Pleuronectes punctatus, Bloch), *taken near North Berwick; and of the Æquoreal Pipe-fish* (Nerophis æquoreus, Kaup.) *from the Coast of the Isle of May.*

The specimen of this small flat fish of the genus Rhombus of Yarrell was sent to Edinburgh by Sir Hugh Dalrymple. It was taken in the beginning of August last, near North Berwick. Two species of this genus have been described as closely resembling one another,—the *Rhombus hirtus*, or Muller's Top-knot (Yarrell); and the *R. punctatus*, or Bloch's Top-knot (Yarrell). But, unfortunately, the fins of this fish not being perfect made it difficult to decide to which of these so-called species it belonged.* The upper surface, the left, and brown-coloured side of the fish was very rough, and the under surface was white, and also rough, though in a less degree; with the exception of the under side of the head, which was smooth. Muller's Top-knot was described as being *perfectly smooth* on the under surface, whereas Bloch's fish was rough; if this was a correct distinction, it would identify the specimen as being not Muller's but Bloch's Top-knot, which, as far as he was aware, had not before been observed in our neighbouring seas. Muller's fish was also rare; but specimens had been obtained at distant intervals in the Firth, especially towards its mouth. This fish measured about eight and a half inches long, by about five inches across, including the fins.

Dr Smith also exhibited a specimen of the Æquoreal Pipe-fish, *Syngnathus* or *Nerophis æquoreus* (Kaup), measuring twenty inches in length. It was taken about three weeks ago among the long weed on the coast of the Isle of May. The dorsal fin, the only fin this species has, was about two and a half inches in length, and terminated nearly in the middle of the length of the fish, the vent being in a line with the beginning of the last fourth of the fin. It is of rare occurrence in our seas. Dr Parnell says, "this fish was first recorded as British by Sir R. Sibbald in 1655, who obtained a specimen in the Firth of Forth. No other instance of its occurrence in that locality has since been noticed. It is one of the rarest of our British fishes." Dr Kaup says, "This species has till now been found only on the south-west coast of Scotland, in Ireland, the Isle of Man, at Havre, and in Norway." He was indebted for the fish to Mr John Anderson of the Royal Emporium, George Street; and he had the pleasure of presenting it to the Museum of the University. His friend Dr M'Bain had in his possession an imperfect specimen taken from the stomach of a cod, which was purchased in Edinburgh.

(2.) *Dr John Alexander Smith exhibited Specimens of the Stoat* (Mustela erminea); *the Ruff* (Tringa pugnax); *the Shoveller* (Anas clypeata); *and the Young of the Black Scoter* (Oidemia nigra).

Messrs John Dickson & Son, gunmakers, Prince's Street, had sent for exhibition two specimens of the stoat or ermine (*Mustela erminea*,

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* Sir John Richardson since the date of this meeting, has kindly informed Dr J. A. S. that he is "not convinced of the two species being distinct, and the 'Skandinaviens Fiskar' contains a fine figure of an intermediate form: all three are probably slight varieties."

Lin.) got in this neighbourhood. One was killed as early as the 27th of October, but the other not till the beginning of January. They were both nearly pure white, with the point of the tail black; showing the severity of the season.

A male and female ruff (*Tringa pugnax*), shot in the neighbourhood of Carnwath in the beginning of September, were exhibited; and a young male shoveller (*Anas clypeata*), shot near Aberdour in the end of December; the keeper who killed it had never seen the bird before. Macgillivray, in his "British Birds," mentions that "in Scotland no authentic instance of its occurrence, at any season, has come to my knowledge." It has, however, been observed once or twice since his time. Dr Smith also exhibited two large ducks, one killed in November last, on the coast of Mull, the other near Prestonpans, some weeks ago. Their unusual appearance had attracted attention, and gave rise to some correspondence in "The Field," one of the London sporting newspapers, as to the species to which they belonged. The birds, Dr Smith said, were undoubtedly young females of the black scoter (*Oidemia nigra*, Flem.), the least common of our two scoters; and, in this immature plumage, rather puzzling birds to a young naturalist. Their general plumage was of a dusky brown; the top of the head, from base of bill and along back of neck, brownish black; sides of head below eye, of throat, and neck, grayish white; the abdomen of a dull grayish brown, the brown feathers being edged with white; under tail coverts dark brown, no enlargement on bill, which, as well as the feet, was of a dusky brown colour. In one of the birds the bill was of a lighter colour at the nostrils. One of these birds was sent by Mr Sanderson, birdstuffer, and the other by Mr Small, birdstuffer, George Street. Through the kindness of Professor Allman, he was able to exhibit another immature specimen of this bird from the valuable collection in the Museum of the University. The occasional appearance of *Oidemia nigra* in this immature plumage has led, it is believed by naturalists, to the introduction, by mistake, of the *Oidemia leucocephala* (Steph.) among the list of British birds. Jenyns says, there is no good authority for considering the *O. leucocephala* as British. It is a bird of eastern Europe.

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*Wednesday, February* 22, 1860.—T. Strethill Wright, M.D., The Communications read were as follows:—

1. *Notice of various Osteological Remains found in a "Pict's House" in the Island of Harris.* By JAMES M'BAIN, M.D., R.N. (The specimens were exhibited.)

Dr M'Bain said, that the fragments of bone which he exhibited were brought from the Island of Harris, by Captain Thomas, of Her Majesty's surveying vessel Woodlark. They were found during last summer in one of those interesting buildings commonly called "Picts' Houses," which was opened at a place named Nisibost, in the Island of Harris, for the purpose of extending former observations made by Captain Thomas upon these ancient structures. The fragments of bone had been put into the hands of Dr M'Bain, in order to determine to what species of animals they belonged. And as there is historical evidence that the antiquity of "Picts' Houses" extends at least beyond a thousand years, he thought the remains of animals preserved in these buildings worthy of being considered zoologically, in reference to the extinction or extirpation of species. An anatomical description of the bone fragments, fifteen in number, was given. They belonged to the following species of animals:—The dog; the common seal; the red deer (part of the antlers of which had been cut and fashioned by a sharp instrument); the "Bos longifrons," characterised by the form of the cancellous horn-core, which formed one of the specimens; the sheep, of small size; and the right middle metacarpal or cannon bone of a small horse, rather larger than that in the skeleton of a Shetland pony in the Barcleian Museum of the Royal College of Surgeons of Edinburgh. These fragments of bone were found on the clay floor of a "Pict's House," buried under a mass of drift sand ten feet thick; and in an adjacent cell, a stone querne or hand-mill for grinding corn was discovered, made of hornblende slate, but too much decomposed for preservation. Dr M'Bain stated that "Picts' Houses" had been divided into two classes—the superficial, or those which are built upon the natural surface of the soil; and the subterranean, or those which are excavated to a greater or less extent beneath the surface. That examples of each class existed in the Orkney Islands, where several "Picts' Houses" had been explored. They had generally been found to contain the bones of domestic animals, such as the sheep, ox, and horse, along with abundance of shells of the edible species of mollusca. In the ruins of a "Pict's House" near Skaill, on the mainland of Orkney, the tusk of a wild boar was discovered, "its presence," as it had been remarked, "taking us back to a very early period." In a subterranean "Pict's House" opened at Savrock, near Kirkwall, in 1848, the head and part of the horns of the red deer were found, along with the bones of sheep, cattle, horses, and a large bone of a whale. The red deer must soon have become extinct in Orkney, for there is no certain historic record of its being alive in the islands, although the contrary seemed to be indicated by the fact that a headland and a harbour still retained the names of Deerness and Deersound. Reference was then made to a collection of bone fragments in the Antiquarian Museum of Edinburgh, presented by A. H. Rhind, Esq. of Sibster, obtained from a "Pict's House" at Kettleburn, in the county of Caithness. This collection contains the bones of the goat, pig, rat, and fish, besides those belonging to the same species of animals as the fragments from Nisibost. Dr M'Bain concluded by saying, that the investigation of "Picts' Houses," Pictish broughs or castles, tumuli, and other structures supposed to be of contemporaneous age, had hitherto been undertaken chiefly upon archæological and ethnographical considerations. That the primitive construction of these buildings, especially in respect to the form of the arch, the absence of mortar and lime for cement, and other indications of a low state of architecture, carried us back to a remote period of barbarism, perhaps not far in advance of the time when the *Bos primigenius*, with other extinct or extirpated animals, roamed over the wild parts of Britain. That considerable attention had been paid to the preservation of implements, weapons, ornaments, and other relics of human art, disinterred from these ancient dwellings; but it did not appear that much care had been bestowed upon the animal remains, which were at least of equal importance. That the object of his communication was to show that these had a special zoological bearing, and that much information of a definite character might be obtained if the subject were to engage a more general interest, and if every one having an opportunity were careful in collecting and preserving the remains of animals found in these primitive habitations of our Celtic ancestors.

### II. *On the Structure of Pearl.* By Alexander Bryson, Esq. (Numerous illustrative specimens were exhibited.)

The author commenced by stating that the first mention of pearls being used as ornaments by mankind was found in the ancient writings of the Chinese. So early as twenty-two and a half centuries before the Christian era, pearls are enumerated as tribute or tax. In the Rh—ya, a dictionary compiled one thousand years before Christ, pearls are mentioned among the most precious products of the empire. Grill, a Swede, long resident in China, was the first who published an account of the Chinese method of forming artificial pearls. This interesting paper is published in the Transactions of the Royal Swedish Academy for 1772. He says—When the shells (the *Unio plicatus*) rise to the surface of the water to sun themselves, they open their valves. The Chinese, watching their opportunity, insert between the mantle and the shell a string of coarse, ill-coloured pearls, placed at intervals on a cord or wire. When these are inserted, the shells sink to the bottom of the pond, where they are allowed to remain for one year, when they are fished up and opened; the coarse rough pearls are now found coated with a fine covering of nacre. In the joss shells are placed clay images of Buddha, which, when sufficiently covered with nacre, are skilfully sawn out by the Chinese, and worn and worshipped by them as the emblem of the creative power. Lin-of the required form, and placed between the mantle and the shell of a nacre-producing mollusc; when sufficiently coated, it is filled with mastic, and a small plate of mother-of-pearl placed at the back. In regard to British pearls, the author stated that the first notice of the gem was by Tacitus in his "Life of Agricola;" and that the pearls were the product of the fresh-water mussel of our rivers (*Unio margaritafera*), was evident from the description, that they were "not very orient, but pale and wan." To the theory advanced by Arnoldi in 1696, anew by Sir Everard Home in 1818, and also by Kellart in 1858, that pearls, or rather their nuclei, were due to the sterile ova of the molluscs which produced them, the author gave his decided opposition, as, from all the facts which he had observed, pearls were entirely due to a secretion from the mantle of the animal. To illustrate the structure of pearls, Mr Bryson exhibited a large series of sections which he had prepared, and by which he showed that by the microscope he could at once determine what shell had produced them. He also explained the rationale of the irridescence of mother-of-pearl,—a discovery due to Sir David Brewster, who proved that it was due to the diffraction of the rays of light, caused by the outcropping edges of the laminæ, and in some cases to the minute plication of a single lamina. This phenomenon was also shown by Barton's patent buttons, where the irridescence was produced by thousands of minute lines, so near each other as to require a high magnifying power to resolve them. By taking an impression with black wax under considerable pressure, the author succeeded in obtaining the same irridescence as exhibited by the button itself. This experiment Sir David Brewster had tried with success in 1815, by taking an impression in wax from a mother-of-pearl button, and by which he demonstrated the cause of the phenomenon. The commercial value of pearls, the author stated, was still as high as in the days of Cleopatra. A good Scottish pearl, with fine lustre, of the size of a pea, fetches from L.3 to L.4. The famous wager between Antony and Cleopatra gives us an insight into the value of pearls. The two pearls which that luxurious queen resolved to dissolve in vinegar, and serve up at the costly banquet, were valued at ten million of sesterces, about L.76,000 sterling. The pearl in the possession of Mr Hope, M.P., the largest of modern times, is not worth a fourth of that sum. The weight of this pearl is 3 oz.; it is 4½ inches in circumference, and 2 inches in length. Notwithstanding the great value of the pearls, the shells of the animals yield now a far more profitable return than the jewels. In 1856, the total value of the pearls imported into this country was L.56,162, whereas the imports of 2102 tons of mother-of-pearl shells were valued at L.76,544. Mr Bryson suggested that trials should be made to produce artificial pearls from the *Iridina*, a nacreous shell, having a much higher lustre than any hitherto found. It inhabits the Nile and Senegal rivers.

### III. *Notes from the neighbourhood of Stranraer—on the Chough or Red-legged Crow* (Fregilus graculus); *on the Migration of the Swift* (Cypselus apus, Flem.); *and on the Effects of the severe Gale on the 9th September last.* By the Rev. THOMAS B. BELL, Leswalt, Wigtonshire. Communicated in a letter to Dr J. A. SMITH.

The Rev. T. B. Bell, in his communication, says,—"The chough is common all along our rocky shores, building on cliffs and in caves along with his mischievous companion the jackdaw, and sometimes in the same cave with the rock pigeon. He annoys the farmers by digging up the sprouting wheat, and tearing up the roofs of their stacks. He is not by half so wary as either the rook or jackdaw, and consequently falls a frequent victim to the herd-boy's gun. He is a pretty bird, very easily domesticated, but void of genius. He does not care to congregate, is not clamorous, and never goes far inland—perhaps not above a mile; but he shifts his roosting quarters frequently from one cave or rock to another, probably just because the wind shifts.

"On the 19th of July last, I observed a migration of several hundreds of the common swift. I knew that these birds, breeding only once in the season, were the first of the swallow tribe to leave our shores, but I had no idea that they left us so early. I have not had any opportunity of watching their habits for nearly twenty years, as they do not frequent this peninsula; indeed these are the first I have seen here during a residence of nearly nineteen years. Perhaps I may mention the particulars of this flitting in as few words as possible. *1st*, The weather was very warm and still, with a few fleecy clouds overhead. The hour was between five and six in the afternoon. *2d*, The direction from which they came was N.E., as I thought—probably from Ayrshire. They passed over me as I stood on the shore, at a spot about five miles north of Portpatrick, and, holding on their way, I judged, that they would reach the Irish coast somewhere about Portaferry. *3d*, Their flight was direct, and steady, and quiet—no wheeling nor screaming, such as they practise when feeding or sporting round some old gray tower. They seemed to have important business on hand, and went about it in a businesslike way. The level of their course was not high. They swept over the cliffs, which are not above 150 feet high, and seemed to retain the same level, as far as I could see them crossing the Channel. I should guess the height at about 250 feet, or even less. *4th*, The order of flight.—They travelled in a wide column. The individual birds were many yards asunder; some were 100 yards to one side, some as many to the other side of me, and in this fashion I observed them for fully twenty minutes; sometimes there were twenty in sight directly overhead, then half-a-dozen, then for a second or two there were none, and then another scattered detachment. In this order the stream flowed on, till at length it ceased. It is difficult to conjecture how many there may have been in all; at the time I guessed them at nearly a thousand. I never had an opportunity of witnessing the migrations of any of our smaller birds, except occasionally flights of linnets in beating up to windward before a gale; and I thought that to escape hawks they invariably moved under cover of night. Larger birds, such as ducks, geese, swans, I have frequently seen on the move in daylight; while the swallows which congregate on our house-tops in September sea-fowls. From Corsewall Point to the Mull of Galloway, all round the shores of the Bay of Luce and of Loch Ryan, razor-bills and guillemots were lying in heaps. I did not observe any other species. I do not think it difficult to account for the destruction of these pretty birds. From the middle of June till the gale came on, the waters off our coast were literally swarming with the fry of various fish. The consequence was that the sea-fowl congregated in unusual numbers, which seemed to increase day by day. The storm came on suddenly, and was of unwonted violence for the season of the year. The fry were of course either driven off or compelled to retire from the surface. The long-winged gulls and gannets were able to get away by flight; while the short-winged razor-bills, who trust more to their paddles than their pinions, had nothing for it but either to breast the sea, or drift on to a lee shore. Deprived of food they could not long face the heavy sea that came rolling in from the Atlantic, and having struggled on for several days they were at last swept ashore—most of them dead, some so exhausted that they could make no effort to get away. Though thin, they were not *so thin* as to suggest starvation as the *sole* cause of their death; but want of food for several days, combined with the exhaustion induced by struggling so long against a head sea, seems sufficiently to account for the prodigious mortality among them. This is confirmed by the fact that no gulls nor gannets perished. The former easily obtained shelter and food on shore, while the latter, with their tremendous power of flight, escaped to sheltered bays and coasts.

"Several years ago we had a great mortality among the guillemots, but the features of the case were quite different. During a heavy fog in the month of April a large flock of these birds were seen circling over the point of the pier at Stranraer. Next morning they were found dead and dying, scattered all over the country, some of them miles inland. I presume they had been trading to the south—had in the mist mistaken the entrance of Loch Ryan for the Channel; that they were brought up by the shore, where they expected to find open sea; in fact, that they had lost their way, and perished in attempting to find it again.

"I cannot say that there is anything remarkable in our fauna. We have few rare birds. The quail is resident; it is known by the name of 'wet-my-foot,' words which its cry closely resembles; and the country people fancy that it is like the peacock and raven, vociferous before rain. The young quail early develops his pugnacity; although there are twelve or fifteen in a brood, they cannot live in harmony till able to fly; by the first of August they are broken up into parties of two or three. In summer we have the pippet, the blackcap, and the grasshopper warbler. The wild swan visits us in severe winters. Some years ago a wounded female remained on the lake at Lochnaw, and during several successive seasons bred with a male of the mute swan. The progeny were genuine mules, and did not breed. A golden eagle sometimes floats high overhead, trading between the Morne Mountains in Down and the solitudes above New Galloway. He occasionally descends to the ground."

The Society were much indebted, Dr Smith said, to the Rev. Mr Bell for his communication, including, as it did, various interesting facts from his own observation. He exhibited a specimen of the chough sent him by Mr Bell, and also one from Cornwall, which had been presented to him by a friend. The bird was supposed by some of our ancient writers to be peculiar to Cornwall; and hence arose the name of the Cornish chough. In Cornwall, at least in the western part of the county, it seemed now to be rare, as Dr Smith had seen no specimens there during a visit he had the pleasure of paying last autumn to that most interesting county.

It was, however, a rare bird, although found at various places along the rocky coasts of Britain, and appeared to be abundant in Wigtonshire. It was found in the island of Mull, in Skye, and at St Abb's Head, on this side of the island. The account of the migration of the swift was also very interesting. It seemed to have been rather an early one; at least this bird is generally described as leaving us about the beginning or middle of August.

### IV. (1.) *Notice of a New Leaf Insect.* By ANDREW MURRAY, Esq.

Mr Murray exhibited a beautiful photograph of the under side of a butterfly, in every respect exactly like a dead leaf. He had received it from Dr William Traill, H.E.I.C., presently stationed at Russelcondah in the Madras Presidency. Dr Traill, in transmitting the photograph, writes:—"I wished to have sent you a curious insect, brought to me as a leaf insect. In Singapore and the Straits, where a variety of these singular forms are found, they are all allied to the *Orthoptera*, or the genera *Mantis*, *Empusa*, *Phasma*, &c. I am a good deal accustomed to their various forms, but on this occasion I was completely taken in, and until the animal moved, I thought it a dead leaf. To my surprise, I found it to be a butterfly! When at rest, its two anterior wings (which are slightly falcate at the tip) were pushed forward in front of its head, so that a central line on them exactly met a similar central line on the posterior wings, so as to simulate the mid-rib of a leaf. The four wings so disposed presented the most exquisite resemblance to an autumnal leaf; and even the veining is represented with wonderful fidelity, especially if the animal is held two or three feet from the eye of the spectator. A remorseless rat one night carried off the insect, along with the pin on which it was impaled; but I had a few days before got a photograph of it made, which I now send you. It is, however, very far from giving a just idea of the original. The upper side of the wings were most brilliantly coloured, but I do not remember exactly what colours." Of course, these brilliant colours will only be seen when the insect is in motion; when at rest, and more exposed to danger, the folding back of the wings conceals them, and shows only this extraordinary resemblance to a leaf. The resemblance is every whit as great as that exhibited by the leaf insect proper (*Phyllium*), only being that of a dead leaf instead of a green one. The insect appears to be undescribed, and, from its powers of concealment, is no doubt rarely captured. Most butterflies have lines on the anterior and posterior wings, often both above and below, which become continuous when placed in juxtaposition; and there are several exotic species which have a line similar to the mid-rib of a leaf figured upon the under side of the wings; but none hitherto described at all approach the present in its close resemblance to a leaf, both in shape, veining, and shading. It is impossible, from merely a photograph of its under side, to determine its genus; but from its falcate anterior and single-tailed posterior wings, it probably belongs to the same group of the *Nymphalidæ* as *Amathusia* and *Zeuxidia*.

### (2.) *Description of New* Sertulariadæ, *from the Coast of California.*
### By ANDREW MURRAY, Esq. (With two Plates.)

The interest which attaches to the existence of closely allied forms in far distant regions induces me to publish the following isolated descriptions of five new Sertulariadæ from the coast of California.

With one exception, they are all most nearly allied to species found on the British coasts, viz. to *Sertularia operculata*, *S. filicula*, *Plumularia falcata* and *Plumularia cristata*; and I may notice that along with them I received the stems of a *Eudendrium* which I cannot distinguish from *E. ramosum* of our own coast, although, from the want of the vesicles it is impossible to decide whether it is a distinct species or not.

To secure absolute accuracy in the figures, they have been drawn by the aid of the camera lucida.

### 1. *Sertularia tricuspidata*, Murr. Pl. VI. fig. 1.

Cells inversely pear-shaped and nearly opposite, a single one in the axilla of each pinna; mouth at end of cell, aperture obliquely truncate, tricuspid at the outer edge; middle cusp longest. *Vesicles unknown.*

The habit of this species is perfectly that of *S. operculata*. Its cells, however, are broader, shorter, stouter, and less acutely conical; they are not perfectly opposite; they do not meet each other at the base, and are more everted; they are tricuspid on the outer lip, the middle cusp being longest, and the lateral cusps are nearer it and more reflexed than is the case in *S. operculata*, when it has two lateral teeth.

It grows in tufts from 2 to 3 inches high, flexuose and serrulated, with polype-cells which are fully as much everted as is usually the case in this family, instead of being less so, as is the habit of *S. operculata*.

There were no vesicles in my specimens.

Bay of San Francisco.

### 2. *Sertularia labrata*, Murr. Pl. VI. fig. 2.

Cells nearly opposite, a single one in the axilla of each pinna; mouth at end of cell; lip distinct, not toothed; aperture obliquely truncate. Vesicles not known.

Like *S. filicula* in habit. The cells, however, are differently shaped, more like those of the last species, but not toothed. The lip is distinct.

I have received only a minute portion, without vesicles.

Bay of San Francisco.

3. *Sertularia corniculata*, Murr. Plate VI. fig. 3.

Cells not quite opposite, sometimes nearly alternate, forming an open cup resting on the stem; lip not distinct; exterior margin somewhat projecting at tip; a single one in the axilla of each pinna. Vesicles pear-shaped, with two long points projecting like horns at the thick end; aperture between them.

This is a very elegant little species, and is easily distinguished by the two long horns at the top of the vesicles, which remind one somewhat of a fool's-cap, and by the wholly open cells.

Bay of San Francisco.

4. *Plumularia gracilis*, Murr. Plate VII. fig. 1.

Stem slightly flexuose, branched; branches alternately pinnated; cells ranked closely in twos and threes; tubulous, with a plain rim slightly peaked in front; vesicles oblong-oval.

The characters of this *Plumularia* do not differ greatly from those of *P. falcata;* but its habit is so different that it can scarcely be mistaken for it. The branches are closer, and more thickly set, than in *P. falcata;* their arched disposition is wanting; and the whole plant has more the aspect of a *Sertularia* than a *Plumularia.* The cells are proportionally larger than in *P. falcata;* instead of a plain truncate rim, other. The cells are wider-mouthed and shallower. Besides the projecting process in front, there are about ten teeth round the margin instead of eight, and they are unequal instead of being equal; the first two and the last two are long and slender, and the whole are variable in size and development. The vesicles are considerably larger than in *P. cristata*, and the ribs are toothed.

When dry, this species, like *P. cristata*, becomes curved in a falcate manner, and the pinnæ are frequently laid to one side, so that it assumes a good deal of the form of an ostrich plume, in reference to which I have given it the above specific name.

Bay of San Francisco.

### EXPLANATION OF THE PLATES.

*Plate VI.*

Fig. 1. *Sertularia tricuspidata*, natural size; *a*, portion of same, magnified.
Fig. 2. *Sertularia labrata*, nat. size; *a*, portion of same magnified.
Fig. 3. *Sertularia corniculata*, nat. size? *a*, portion of same magnified.

*Plate VII.*

Fig. 1. *Plumularia gracilis*, nat. size; *a* and *b*, portions of same, magnified.
Fig. 2. *Plumularia struthionides*, nat. size; *a*, portion of stem, magnified; *b*, vesicle, magnified; *c*, portion of pinna, magnified; *d* and *e*, cells, more highly magnified.

### (3.) *Notice of* Chameleon tricornis. By Mr MURRAY.

Mr Murray brought under the notice of the Society some peculiarities of this curiously-formed species of chameleon, which had been brought from the interior of the Old Calabar district of West Africa, by one of the natives, to the Rev. Mr Baillie, by whom it was presented to Mr Murray. The male is characterised by three salient horny processes on the head; the female has not these. Many lizards have singular spiny projections on all parts of the body. In allusion to the prongs on the head it had been named *Chameleon tricornis*; but it had also two other names, *C. Owenii* and *C. Bibronii*, the latter having been applied to the female.

The Rev. Mr Baillie remarked, that this species was said by the natives to feed upon a particular kind of tree, on which it was usually found; but that this was, no doubt, an error, arising from the chameleon frequenting this tree in consequence of its being more peculiarly the habitat of the insects it fed upon those around it.

V. Dr JOHN ALEX. SMITH exhibited a Ballan Wrasse (*Labrus bergylta*), caught in October last in Loch Fyne; sent by Captain J. W. P. Orde, of Kilmory Lochgilphead, Argyleshire. It measured about 14 inches in length, and displayed a few green spots on the hinder part of the dorsal fin, which were now faded. This species was distinguished by the soft rays of the dorsal fin, measuring twice the length of the twenty (first) spinous ones. The Society had been indebted at various times to Captain Orde for the exhibition of specimens of interest. The ballan wrasse was a rare fish in our Firth, and was found generally on rocky coasts. Dr Smith had seen some large ones last autumn, caught at the rocks beside the Lizard Light in Cornwall.

VI. Dr JOHN ALEX. SMITH exhibited a specimen of a female Gadwall duck, *Querquedula strepera*, one of our very rare winter visitors. It was shot near Cromarty in the end of January, and was sent to Dr Smith by Mr Muirhead, Queen Street.

Dr Smith referred to the great abundance in this neighbourhood of the Brambling, *Fringilla montifringilla*, and of the Siskin, *F. spinus*, during the severe weather of the winter; and also to the multitudes of wood pigeons, *Columba palumbus*, which, from stress of weather and starvation, had been driven from the more open and wooded districts to the neighbourhood of our gardens and towns, and had eaten up, with the exception of the leek, all kinds of garden produce.

The thanks of the Society were given to the Rev. Mr Bell and Captain Orde for their communications and exhibitions of specimens.

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*Wednesday, March* 28, 1860.—ALEXANDER BRYSON, Esq., President, in the chair.

William S. Young, Esq., Fillieside House, was elected a member of the Society.

The following donations to the library were laid on the table, and thanks voted to the donors:—

The Canadian Journal of Industry, Science, and Art, New Series, No. 20, January 1860. Toronto.—By the Canadian Institute. Proceedings of the Academy of Natural Sciences of Philadelphia, 1858.—From the Academy. The Rocks of Kansas (with description of Permian Fossils).

be glad to receive contributions for this object, and the list of subscribers would be left in the hands of Mr Dawson, 6 York Place.

### *Hugh Miller's Museum.*

Dr J. A. Smith stated he might also take this opportunity of informing the Society that the movement begun some time ago to raise money by public subscription, for purchasing the Museum of the late Hugh Miller, had been brought to a successful termination. A committee was appointed, of which he had the honour to be a member; and the result of its labours was that above L.600 had been collected. With this sum, and the addition of the Government grant of L.500, the Museum had been purchased, and was now in the custody of Professor Allman, in the rooms of the University.

The communications read were as follows :—

### I. *On the Employment of Transparent Injections in the Examination of the Minute Structure of the Human Pancreas.* By WM. TURNER, M.B. (Lond.), Senior Demonstrator of Anatomy, University of Edinburgh.

The investigation of the relations of the minute gland ducts to the ultimate gland follicles in the human pancreas presents considerable difficulties. This is owing, partly, to the great delicacy and transparency of the structures, and partly, because from the close manner in which the minute lobules of the gland are crowded together, it is difficult to obtain a satisfactory view of a single isolated lobule. Thus, the mode of connection of the fine excretory duct of the lobule with the sacculated gland follicles at its extremity cannot clearly be estimated. Moreover, if it is attempted to separate the lobules from each other by tearing them asunder with needles, the relations of the parts become so disturbed, that the examination does not afford any very decided results. For these reasons, it has been customary, in describing the minute structure of this gland, to refer especially to the appearance which it presents in the smaller and more common Rodents, such as the Rat or Mouse.

In these animals the pancreas is spread out in a thin arborescent manner between two layers of peritoneum, so that the different lobules lie mostly on the same plane. Their investigation is on this account comparatively easy, even without the aid of any dissection.*

Being engaged some months ago in making a series of preparations of the human pancreas for the sake of illustrating the structure of this gland to my microscopic class, I succeeded in forcing an injection through the excretory duct into the ultimate follicles of the gland. I have been enabled in this manner to obtain, much more satisfactorily than by any other process, definite views of their relations to each other. The injecting fluid which I used was of the same composition as that recommended by Dr Lionel Beale, and employed by him with such success in his investigations into the minute structure of the liver. It is composed of a mixture of glycerine, spirits of wine, and water, in which Prussian blue, obtained by precipitation, is suspended.

This injection possesses the great advantage of flowing easily when cold along the ducts, and from its great transparency, the organ into which it is thrown can be examined by transmitted light, and by high magnifying powers, so that the connections and relations of its component structures can be much more readily traced than in those cases where opaque injections are employed. It is hardly possible, however, to make a complete injection of all the ultimate lobules throughout the pancreas; for in many parts they appear to be so filled

filled by the injection; for in them the general and relative arrangement can be more distinctly seen than in those lobules which are completely distended, as in the latter case, owing to the amount of injection in them, a degree of opacity is produced which renders the outline of many of the follicles somewhat indistinct. Most of the sections which I have examined have been made with a Valentin's knife, and the preparations have been soaked for a short time in glycerine, which facilitates the investigation of the pancreas, as of many other animal textures, by increasing the transparency.

The large excretory duct of the pancreas extends along the centre of the gland from head to tail, and is enclosed on all sides by the large lobules. From it, at frequent intervals, smaller ducts proceed, which pass into these large lobules, and in them divide and subdivide into fine branches, for the ultimate lobules. Of these fine branches some arise at right angles, others at a more or less acute angle, and after a very short course they become connected with the ultimate gland follicles of the lobule to which they belong. Each duct, as a general rule, preserves the same calibre from the point at which it commences, to that at which it either gives off a branch, or terminates in an ultimate lobule. In some instances the ducts possess dilatations on their walls, which may either be confined to one side, or may exist at corresponding points on both sides. The same mode of termination of the fine ducts in the ultimate lobules does not appear to exist in all cases, but admits of slight differences. In some instances the duct passes to the base of the lobule, and then from it, as from a centre, the saccular dilatations of the ultimate follicles spring. In others the duct runs for a short distance along the base of the lobule, giving origin in its course to the follicles, which are connected to its sides and extremity. In either case the fine membrane forming the wall of the duct is continuous with the membrane constituting the wall of the follicles, so that the cavities of the follicles are continuous with that of the duct. The number of follicles present in an ultimate lobule varies considerably in different specimens. There are also great differences in their shape and size. Some are spheroidal, others laterally elongated, so as to pro-sent a more or less oval form ; others again are more pyriform When distended by injection, they all present convex, smooth, and well-defined outlines. On account of the general shape of the follicles, and the mode in which they are grouped together in the lobule, they resemble in appearance a bunch of grapes, with which they have frequently been compared.

The epithelial contents of the follicles are of course completely concealed in the injected portions of the gland ; but in those lobules into which the injection has not passed, the shape and general arrangement of the secreting epithelium may be conveniently studied. It frequently happens that, in examining sections of the gland, isolated follicles may be seen, lying perhaps closely together, as if they had originally formed parts of the some lobule, but still separated by slight intervals from each other, having probably become detached from their original connections in the act of making the section. In these isolated follicles the secreting cells may be generally very distinctly seen. They form a closely packed layer, lining the inner surface of the membrane forming the wall of the follicle. Their shape is spheroidal, so that they form a true glandular epithelium.

Professor Kölliker in his "Microscopic Anatomy," describes the pancreas as belonging to the compound racemose group of glands, of which the salivary glands and the mucous glands of the mouth may be taken as the type. In his description of the last-named glands, he states that the grape-like appearance [redacted] with that forming the wall of the duct, and that the cavity of the one is continuous with that of the other.

In this communication I have avoided the use of the term acini, as it has been employed by different observers to express different structures, so that its use is liable to lead to confusion of ideas; some applying the term to express the ultimate lobules of the gland, whilst by others it is used to signify the ultimate follicles of these lobules.

## II. *Notice of Reptilian Fossils, Morayshire.* By WILLIAM RHIND, Esq.

The specimens which Mr Rhind exhibited of reptilian remains from the sandstone of Moray were contributed by Patrick Duff, Esq. It is now about a quarter of a century since the late lamented President of this Society, Professor Fleming, first detected an organism in the Old Red Sandstone of Scotland. It was but a minute fragment of a fish scale, yet it had the effect of awakening an interest for, and stimulating a research into, those beds of sandstone which skirt almost the whole of the Scottish shores to the north of the Firth of Forth, and which hitherto had been looked upon as destitute of organic remains. A few years after this discovery, Mr Duff began his researches in Morayshire, with an enthusiasm and perseverance which have seldom been equalled. He soon found that the sandstones of Moray teemed with organic remains, as well as these of the opposite shores of Cromarty, which were at the same period under the scrutiny of Mr Hugh Miller. From that time Mr Duff has formed the nucleus round which the researches of other scientific men and the casual discoveries of the workmen in the various quarries have centred, so that a most varied and interesting assortment of specimens have been accumulated. As long as the organisms brought to light partook of the character, or were supposed to do so, of fishes, no doubts remained that the sandstones of Moray, under the several modifications of colour and position, belonged to the Devonian era; but subsequently, when organisms of a higher order made their appearance, assuming the distinct forms of reptiles of various families and sizes, a doubt began to arise whether the fish-bearing and the reptile-producing strata belonged to the same series. This *questio vexata* still prevails; and Mr Rhind, assuming that the decision is still left open, proceeded to exhibit by a section the relative positions of the sandstone beds, in so far as these are open to inspection. The general conformity of the lowest red, the greyish, and the yellow sandstones,—the parallelism of the dip of these three beds of strata, and the superposition of a band of limestone or *cornstone* commencing south of Elgin, and seen with more or less interruption at Linksfield, Spynie, and Stotfield, capping and inclosing the whole series, were pointed out; while the absence of scales of the distinctive fishes of the Devonian era in the particular localities where the reptilian remains have been discovered was also mentioned,— an absence which probably may arise from as yet defective search, considering that the accidental disinterment of the reptiles has occurred within the short space of a few years, and that another few years may either add the discovery of fish scales, or, if not found, afford a somewhat negative proof of the non-identity of the yellow sandstones with the Devonian. It was also suggested that the appearance of the vast masses of compact sandstone forming the hills which traverse the lower region of Moray from west to east, indicated a process of accumulation by drifting, rather than that slow and regular deposition which is indicated in the lower red sandstone beds, where conglomerate, shale, and fine-grained sandstones are alternately superimposed,—a condition always favourable to the existence of organic remains either of plants or animals; while the drifting process, which carried the land reptiles into the sea, was unfavourable to the preservation of fishes. Lastly, allusion was made to the recent discoveries of vegetable remains of Lepidodendrons, Lycopodiums, and others analogous to those of the coal strata in the true Devonian sandstones of Canada, by Mr Dawson, and of similar fossil plants found in the Caithness slates, by Mr Salter,—all indicative of dry land, and the progress of organic life during the period of the Devonian Sea.

## III. *Contributions to the Fauna of Old Calabar—Mammals.* By ANDREW MURRAY.

This paper was chiefly occupied with a list and notes relating to the various animals, of which specimens had been sent at different times by the United Presbyterian missionaries stationed at Old Calabar, among which were the following:—

*Troglodytes niger*—The Chimpanzee.

With reference to a specimen of this animal which had been brought away alive by the Rev. Mr Baillie, but which unfortunately died on the passage home, Mr Murray remarked, that it had been preserved by Professor Goodsir, in a way which, if it should prove successful, was well worthy of adoption, in cases where the rarity or value of the specimens might justify the expense. The plan was to place it in spirits in a glass tank or coffin as it were, covered with glass hermetically sealed meats, which were kept in a press or cupboard, but to prevent its getting access to them when not wished, the cupboard was kept locked. On one occasion the key had been forgotten and left lying on the table, the chimpanzee noticed this, secured the key, and when no one was present, proceeded to unlock the door of the cupboard, but being unable to reach the key-hole, drew a chair to the side of it, and getting up on it unlocked the door, and so got access to the desired sweetmeats, an act involving more than one process of that kind of ratiocination which is usually thought the exclusive property of man.

*Galago Murinus.*—(Murr.)

In addition to the information formerly given regarding this interesting little animal, Mr Murray had received some additional facts, communicated to him by the Rev. W. C. Thomson, through Dr Hewan. From these it appeared that the little creatures are gregarious, or social rather, travelling in small companies, and inhabiting a common nest; one of which Mr Thomson got a glimpse of. He saw several individuals rush out of it as he passed, and it answered in its situation and description to the account he had received of them, which was, that they were built on suitable forks on trees, with a foundation of clay, and superstructure of dried leaves.

*Stenops, Potto* (?).

Two or three specimens of this curious loris have been received, and the singular structure under the tongue (a development no doubt of the frenum, but exceedingly like a bird's tongue), as well as the rete mirabile of the arteries of the limbs, was well shown in Mr Murray's preparations.

The sublingual plate is also found in the Galago, although less developed.

*Mephitis*—Sub Genus *Rhabdogale* (sp. ?)

Mr Oliphant has received a specimen of an animal which Dr Cleland, to whom he has presented it, refers to this genus, but he has not yet satisfied himself as to the species.

*Anahyster*—(Nov. Genus of Otters.)—*Calabaricus Murr.*

If a difference in the dentition be, as is usually allowed, sufficient to warrant the separation of the animal possessing it into distinct genus, then the present species is entitled to that place.

It is as yet only known by the skull, which was sent by Mr Thomson to Mr Murray. Its dentition differs from that of our common otter, *Lutra vulgaris*, in having one fewer pre-molar in the upper jaw. Mr Murray had submitted it to Professor Owen, who believes it to be nondescript, and that it approaches *Enhydra* of Fleming (Phil. of Zool.) in having the first pre-molar suppressed above, but that the latter has also the first pre-molar suppressed below. It has, however, six incisors in the under jaw, while the sea otter, *Enhydra*, has only four in the adult state, which the specimen in question has.

It would appear to form an intermediate link between the true otter and the sea otter; and its habitat in an estuary may therefore perhaps be thought suitable enough; and it was in reference to this that Mr Murray proposed the above generic name for it—*Anahyster* (belonging to an estuary).

*Phacochœrus*, (sp. ?)

Dr Cleland has received a young individual of this genus; there does not appear to be any essential difference between it and the Cape of Good Hope and Mozambique species, *Ph. Æthiopicus*. But the individual is too young to allow an opinion to be given with confidence.

*Hippopotamus amphibius*.—Lin.

***Delphinus*** **(sp. ?)**

Mr Oliphant has received the head of a species of dolphin.

***Rhinomus soricoides.***—(Nov. Gen., Nov. Sp. ?)—Murr.

This is a very puzzling little animal. It has the appearance of a shrew, with its long snout, but is in reality a mouse. Its dentition is somewhat peculiar, the incisors having a process behind them, like the cusp of a carnivorous tooth. It is pentadactylous both before and behind, and as all the allied genera and species have four fingers before and five behind, Mr Murray considered that there was no alternative but to make a new genus for its reception, and in reference to its long snout, he proposed the above name for it.

It is mouse-coloured, with ear and tail.

## IV. *On the Chalk Flints of the Island of Stroma, and Vicinity of John o'Groat's, in the County of Caithness.* By CHARLES W. PEACH, Esq., Wick.

Notices of the occurrence of chalk flints in the boulder clay of Caithness have from time to time appeared in various publications. Many of the localities I have been able to verify, and to add new ones as well. Knowing the interest attaching to their presence so far north, and not being able to find any account in any work that I have access to of their having been *found on the surface of the land*, the intent of this communication is to show that I have been fortunate enough to make that discovery.

On the 5th instant I had to go to the island of Stroma on business. When walking across the north side of it, I was somewhat surprised to find chalk flints in considerable abundance on the surface there. This part of the island is stripped of its turfy covering, and is consequently favourable for observation. Wherever I went, even on ploughed land, and where the short vegetation was not too thick, I met with the flints. They vary in size from that of a boy's marble to eight or ten inches over, and are generally of a light colour. Some contain sponges; in most of them spicula may be seen in thin splinters, which I chipped off, and in one piece I observed those hollow and branched spicula with the small ball-like masses peculiar to the genus Geodia—all beautiful objects for the microscope. A large one, of several pounds weight, contained pieces of shells, a fragment of an echinus, as well as sponge. The flints are slightly waterworn, and many of them covered with lichens. With them are blocks of granite and gneiss, some of large size, smaller pieces of hornblende, reddish conglomerate, quartz, &c., &c.; in short, the usual heterogeneous collection of travelled stones found in these parts. One kind of rock deserves special notice. It is that peculiar quartz rock with the large *annelide-tubes*, so abundant in the highlands of Assynt, Durness, &c., in Sutherlandshire. There is no mistaking it, its character is so obvious. For its history see Sir Roderick Murchison's last edition of "Siluria." I would here remark that the north end and west side of the small island of Stroma have never been under cultivation, being too much exposed to the blighting winds and burning spray which, when the storm is raging, pass over these parts; and, although some of the cliffs are more than 100 feet in height, the sea-water at times rushes in streams thence to the opposite side of the island.

I was told by James Simpson, an intelligent fisherman, that he had often heard his grandmother say, that in her time the supply of peat for fuel for the islanders was cut there, and that the moss was then three feet in depth. All has been long since taken away, and the scanty vegetation and mould which subsequently formed has also been pared off by the flaughtering spade, for divots either for the covering of houses, clay itself are to be seen on the island now, there are evidences of its former presence. But probably it was never of great depth, there being no deep valleys or sheltered coves to retain it on this small spot of land. Add to this the peculiar form of the island, sloping towards the sea on both sides and ends, much like the hipped low roof of a house—in some places descending quite to the level of the beach. Thus, when rising on its return voyage, after being submerged and covered with the boulder clay, as it slowly lifted up its head from the agitated waters of the turbulent Pentland, lashed no doubt then as now by the waves of the restless "Swelkie"* and "Bores"† the softer and lighter portions of the clay were washed out, and passed down the sloping sides in muddy streams, and were swept away by the furious tides which ran past, the more ponderous and weighty materials being left behind. Whence the flints came I do not intend to speculate, but merely mention that many writers upon those found in other parts of Scotland point to Denmark and Sweden. My stay on the island on this occasion was very short, but this is of little consequence, as my son William has since made a thorough inspection of the whole island, and finds flints all over.

The next morning I passed over the Pentland in the midst of a storm, with rain and snow, and whilst my horse was feeding and being got ready for my return home, I took the opportunity of looking round John o' Groat's, and there chalk flints were to be seen, but not in that abundance as at Stroma. I regretted that I could not extend my search further. As the subject is worthy of attention, I hope to pursue my investigations as opportunities offer, for I believe that these flints are wide spread, not only *in* the boulder clays of Caithness, but on the surface also. I hope by thus giving publicity to the discovery that the attention of others may be called to the subject.

* "Swelkie" is a whirlpool off the north end of the island, which at times is very dangerous. A boat, with seven men in it, was drawn in, and all were sucked down and lost.

† "Bores." For instance, off Duncansbay Head the waters rise up all on sudden at certain times of the tide into high waves. It is then dangerous for vessels and boats to pass through—almost certain destruction to boats.

### V. *Note of the* Onuphis tubicola *found near Wick.* By CHARLES W. PEACH, Esq.

I am not aware whether the *Onuphis tubicola* has been noticed as occurring in Scotland. It has been found in Ireland, and I got it rather plentiful in Cornwall. It forms a quill-like tube, which it fixes in the sand. I got one the beginning of this month from a fishing-boat belonging to this place. The animal was not in the tube, and although the tube is injured, there is sufficient left to identify it. The animal is described and figured in the "Annals and Magazine of Natural History" (vol. xvi. page 6, 1845), in a paper by Dr George Johnston of Berwick, fifteen years ago. I supplied him with specimens, and when I lived in Cornwall, I kept some alive for more than a year.*

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*Wednesday 25th April* 1860.—WILLIAM RHIND, Esq., President, in the Chair.

The following donations to the library were laid on the table, and thanks voted to the donors:—Observations on the Free-Labour Cotton of Honduras, &c. With coloured plate of the plant. By Mr James Banks, Prestonpans.—From the author. Lecture on the Geology of the Province of Nelson, New Zealand. By Dr F. Hochstetter, of the Austrian Scientific *Novara* Expedition.—From the Colonial Secretary, Auckland, New Zealand. Memoir on the Extinct Sloth Tribe of North America. By Joseph Leidy, M.D., Professor of Anatomy, University of Pennsylania.—From the author. Report of the Board of Agriculture of

The communications read were as follows:—

### I. *On some Obscure Markings upon an Old Red Sandstone Slab at Mill of Ash, near Dunblane.* By the Rev. Robert Hunter, late of Nagpore.

The large slab, half of which has been laid upon the table, is a micaceous flagstone, from a fissile layer, a few inches thick, with a more compact sandstone or gritstone both above and below it, and at no great distance from a trappean effusion. It would seem to belong to the lowest or *Cephalaspis* zone of the Old Red Sandstone. The Rev. Walter Smith, of Free Roxburgh Church, in this city, when with me last August, in a quarry at Mill of Ash, observed some of the markings on a projecting ledge of stone, and that day and the next he and I laid the rock bare for a space of six feet in length by five in breadth, and came on about 150 of the markings. More recently, the slab was raised, and the Rev. Mr Paterson, of Dunblane, kindly consented to take the trouble of having it packed and forwarded to Edinburgh. The impressions are of two sizes. Their form is elliptical, with a raised border, one side being in much bolder relief than the other; and it is important to note that the raised margins all correspond in position with each other. Within, and separated from the elevated border by a channel, there is occasionally a raised central space, with a tendency to longitudinal furrowing. The longer axes of the ellipses all point nearly in the same direction. They are arranged with some regularity, though at times two are in such close contact as to form an eight figure, and, more rarely, a couple of these eights uniting have constituted a rude cross. Mr Page possesses some curious impressions from Ardoch, a few miles north of Mill of Ash, but judging from some figures he hastily drew for comparison, they are of forms entirely different from those now described. It is difficult to say whether the markings are of organic or inorganic origin. The hypothesis on the subject which most naturally arises, and being expelled has a tendency to return, is, that they are footprints of some animal. There are, however, very formidable objections to this view. Nor can they well have been formed by pebbles, or by the impressions of ganoid scales, for substances generally so indestructible would surely have left some fragment of themselves, more or less, which they have not done. Most of the markings are formed chiefly of micaceous laminæ, like the rest of the rock, and in the two or three instances where the presence of a foreign body can be detected, it seems to be of a concretionary nature. Mr Robert Loudon Irvine, of Hurlet Chemical Works, who kindly consented to analyse one of these foreign bodies sufficiently to determine its chief ingredients, thus reports on it. "It consists mainly of carbonate of lime, with iron existing mostly in the state of protoxide and alumina. There are neither sulphates nor sulphurets present. The black colour is probably due to the presence of carbonate of protoxide of iron." Sir Roderick Murchison and the Rev. Mr Mitchell of Craig have, independently of each other, pointed out a remote resemblance in the impressions to what is in Forfarshire called "the Kelpie's foot;" but neither of those gentlemen regards the phenomena as identical. At the suggestion of Sir Roderick, the matter has been referred to Professor Phillips of Oxford, who has had much experience of obscure markings like the present. He has already received specimens of the impressions; and it is probable that one of the larger pieces of the slab will have to go to England for thorough examination there.

## II. *Notice of Various Ornithic Fossil Bones from New Zealand.*

By JAMES M'BAIN, M.D., R.N.

Rotomarrama, at the bottom of a hill. The entrance is twenty-five feet high and eighteen feet broad, and its mouth is concealed with shrubs. The cave is about a mile in length, running under the hill, and the bones are found in all parts; some under soft sand and limestone, others covered with a crust of limestone only. Glowworms were seen in the cave, but no plants. This is called the Cave of the Spirit. It is held in great terror by the natives, and some now alive say they have seen a living moa, that it lived in the cave, and used to stand on one foot, so that it is just possible that the moa may still be alive in some of the wildest and most secluded parts of the island. Dr Thomson gave some bones to Governor Gray several years ago, and is not quite sure that the governor did not give them to Professor Owen. There is another limestone cave, called the Cave of the Moa: this is of less extent than the former, and is about seventeen miles from Honipaka. The animals resorted to the caves to die. The natives used the larger bones to make fish-hooks, the skulls to hold their tatooing powder, and for other purposes; thus, few of the leg-bones or skulls can now be got."

In November 1839, Professor Owen read a communication before the Zoological Society of London, in which he described a portion of the shaft of a femur, six inches in length, and five and a half inches in circumference, which had been brought from New Zealand. After a careful and critical examination, that distinguished palæontologist pronounced the fragment of bone to belong to a large bird, allied to the ostrich; and staked his anatomical reputation, that species of birds heavier and more sluggish than the ostrich would be discovered to have existed in New Zealand. In less than four years afterwards, this inference was happily confirmed from numerous bones transmitted to this country, which were found in the bed and banks of fresh water rivers at Poverty Bay, buried only at a little depth in the mud. From these fragments of bone, Professor Owen was enabled to establish three genera of extinct birds, which he named Dinornis, Palapteryx, and Aptornis.

In 1847, the late Dr Gideon Mantell received from his son, Mr Walter Mantell, no less than eight hundred specimens of fossil bones, which were obtained from North Island, found in a bed of sand called the "Waingongora Bone-bed." In 1850, another collection of about five hundred specimens of fossil bones were sent home by Mr Walter Mantell, two hundred of which were from the same locality as the former, whilst the remainder were obtained from Waikouaiti, on the eastern coast of the Middle Island. This latter bone-bed is covered by a layer of sand, and appears to have been an ancient swamp or moss, in which the New Zealand flax (*Phormium tenax*) once flourished. A pair of perfect tarso-metatarsal bones were found standing erect in this bed, with all the toe-bones attached, which are now known to form part of the skeleton of the species that has received the name of "*Dinornis robustus.*"

From the fragments of ornithic fossil bones transmitted at various times from New Zealand, Professor Owen has succeeded in establishing thirteen species of extinct birds, differing in size from the great Bustard to that of the Ostrich, and even much larger. These species have been referred to two distinct genera, the Dinornis proper, in which there is no impression for a hind toe on the tarso-metatarsal bones; and to the genus Palapteryx, in which the impression for the fourth toe has a similar position in the tarso-metatarsal bones as in the existing Apteryx. The general anatomical characters assigned by Professor Owen to the skull in this peculiar family of birds are "a broad and low supraoccipital region, sloping scapula, and an interesting little oval bone, doubtless a tracheal ring. The bones are of a yellowish cream colour, light and spongy from the loss of animal matter, but all in a good state of preservation. There are none of the mandibular or facial bones attached to the cranium, a part of the presphenoid, and the whole of the left postorbital process of the frontal bone is broken off, and there is likewise a slight exfoliation at the supraoccipital and paroccipital ridges, exposing the remarkably cancellous structure of the cranium. In the skull described by Professor Owen as typical of the genus Dinornis, and referred to *D. casuarinus*, it is stated, " that the cranial peculiarities of the great extinct wingless birds are exaggerated in the typical genus, especially the downward development and abrupt descent of the basioccipital and basisphenoid, and the forward inclination of the occipital surface, which makes the occipital condyle the centre of the hinder surface of the skull, and places the occipital foramen in the upper half. That the occipital condyle is supported on a short thick peduncle, and impressed by a subcentric pit, whilst the longest diameter of the foramen magnum is in the vertical direction." These characters do not correspond with the skull found in the limestone cave near Rotomarrama.

The cranial peculiarities of the genus Palapteryx are said to be " the minor development of the basioccipital and basisphenoid downwards in comparison with that in Dinornis proper; a higher position of the precondyloid foramina, and their separation from the carotid canals, the square platform of the basisphenoid, the less development of the paroccipitals, and great development of the mastoids and olfactory chambers, and especially in the large and single oblong depression beneath the mastoid, for the single superior condyle of the tympanic bone." In his description of the skull of *Palapteryx gerenoides*, in the collection of Mr Mantell, Professor Owen says, " it agrees with those assigned to Palapteryx in all the characters by which they differ from the cranium assumed to belong to Dinornis proper."

The general construction, measurements, and details of the skull of *P. geranoides*, agree in several particulars with the Rotomarrama cranium; and in the remarks which I have to make upon it, I shall adopt the comparisons made by Professor Owen on the typical skull of the genus Palapteryx. The breadth across the mastoid processes in the mutilated cranium from Rotomarrama is $2\frac{7}{10}$th inches ; the length of the cranium, measured from the upper part of the foramen magnum to the anterior extremity of the frontal bone, is $3\frac{3}{10}$th inches; the breadth across the postorbital processes is $2\frac{6}{10}$th inches; the breadth across the temporal fossæ is $1\frac{7}{10}$ths of an inch. The vertical diameter, from the supraoccipital ridge to the basisphenoid, is $1\frac{7}{10}$ths of an inch. The transverse diameter of the occipital foramen is nearly $\frac{6}{10}$ths of an inch. The breadth across the paroccipitals is $2\frac{1}{2}$ inches. The sutures of the skull are entirely obliterated ; and from the well marked muscular impressions and rugose surface, there is no doubt that it belonged to an old bird. The occipital foramen is subcircular, and broadest transversely; the descending basioccipital is impressed by a shallow pit, divided by a slight median ridge, and bounded below by the straight posterior border of the basisphenoid platform, the outer angles of which are large round tuberosities. The precondyloid foramina are situated at the upper and back part of the basisphenoidal protuberances, midway between the outer edge of the paroccipital ridge and foramen magnum, and raised to a level with the lower border of the occipital condyle. The precondyloid foramina pass obliquely upwards and inwards into the cranium, and there are two small pits at the inner and upper edge, nearer observable. The anterior angles of the basisphenoidal platform are formed by short, thick, outstanding pterygoid processes, with flat oblique articular surfaces for the abutment of the true pterygoids. The presphenoidal rostrum passes forwards from the middle of the basisphenoidal platform to the posterior wall of the nasal chambers, and there is a well marked depression on each side, beneath the optic holes, running backwards at the outside of the pterygoid processes. The foramen ovale is situated in the middle of the alisphenoid, halfway between the pterygoid process and glenoid cavity, with its long axis in a vertical direction. The mastoid process is half an inch in length, compressed laterally, and extends obliquely from without inwards and backwards, with a large single oblong glenoid cavity at the inner side. There is a deep pit between the inner and back part of the glenoid cavity and posterior root of the mastoid process. The deep temporal fossæ lie between the mastoid and postorbital processes, the lower points of the latter being on a level with the former. The distance between the postorbital and antorbital process is 1 inch and $\frac{8}{10}$ths. There is a small oval pit beneath the antorbital processes, the long axis of which runs obliquely from before backwards and inwards. The olfactory chambers reach backwards nearly three-fourths of the length of the orbital cavities. There are two large broad anterior horizontal divisions, and two narrow posterior ventrical olfactory chambers, separated by a slight lateral inflexion of bone at the posterior third of the chambers, and not by a " transverse ridge," as in *P. geranoides*. The anterior chambers are partly roofed over by the prefrontals, wedged in between the anterior extremity of the frontal bones, but principally by the frontals. The posterior divisions of the olfactory chambers are chiefly formed by the orbitosphenoid, ethmoid, and frontal bones. The olfactory foramina and radiating grooves are remarkably distinct, especially at the back part of the anterior larger division of the olfactory chambers.

There is a mutilated cranium of a Palapteryx, which was sent to Professor Owen by the Rev. W. Cotton, from the North Island of New Zealand, described and figured in the Third Volume of the " Trans. of the Zool. Soc.," p. 360 (Pl.

the emeu, and the length of the spinous process, with its inclination forwards, where it abuts against the compressed iliac bones, render it probable that this vertebra had a similar position in the skeleton to which it belonged.

The length of the nine anchylosed sacral vertebræ is four inches; the height of the anterior sacral vertebra, measured from the base to the upper part of the coalesced spinous ridge, is three inches. The bodies of the first two sacral vertebræ are partly separate, the rest are completely anchylosed. The first five sacral vertebræ are furnished with upper and lower transverse processes. The last four are destitute of a lower transverse process. There is a distinct foramen for the exit of the sensory and motor nerves, as in other birds; the ostrich is the only exception to this rule with which Professor Owen is acquainted. The broken portion of a rib measures 3$\frac{1}{2}$ inches, and 1$\frac{8}{10}$th inch transversely, at the broadest part. From analogy with those in the skeleton of the emeu, it appears to have been broken off below the head and tubercle of the third or fourth rib on the right side. The two phalangeal bones are each nearly two inches in length, somewhat compressed laterally, and rounded above. There is a longitudinal groove at each side of the ungual phalanx, and a well marked impression at each side of the anterior articulating surface of the penultimate phalanx. The phalangeal bones are double the size of those of the middle toe in the skeleton of the emeu, but less than those in the ostrich. The bone, which I assume to be a scapula, is 9 inches in length, with a circumference of 6$\frac{1}{2}$ inches at the articulating extremity, where it was incrusted with a layer of calcareous stalagmite, characteristic of limestone-cave specimens. The circumference at the middle is 3 inches, and 1$\frac{7}{10}$th inch at the free end. The surface of the bone is marked with oblique longitudinal striæ, decussating in a somewhat irregular manner from its posterior to its anterior extremity. There are two distinct impressions at the larger extremity, which may correspond to articulating surfaces for a double condyle of the humerus, and a broad transverse impression for the articulation of the caracoid in front. This is an interesting addition to the remains of these extinct birds, as there is no scapula described by Professor Owen in his "Memoirs on the Dinornis."* The small oval bone found along with the other bones is evidently a tracheal ring; it measures $\frac{8}{10}$ths of an inch in length, by $\frac{6}{10}$ths of an inch in breadth, and is about $\frac{1}{10}$th of an inch in depth.

A portion of a vertebra, which has been deprived of its calcareous matter by dilute acid, would seem to prove, by the large amount of residual organic matter, that these fossil bones are probably of recent origin.

It is to be hoped that this interesting collection will ultimately assist in the construction of one of the species of Palapteryx, indicated by Professor Owen from the examination of detached crania, or founded upon the proportions and anatomical differences of other separate parts, or single bones of the skeleton.

## III. *Notice of the* "ANGWÀNTIBO" *of Old Calabar, Africa; an Animal belonging to the* FAMILY LEMURINA; *and apparently to the Genus* Perodicticus, *of Bennett.* By JOHN ALEXANDER SMITH, M.D.

The interesting little animal (now exhibited) was given to me by Mr William Oliphant, who received it some time ago from the Rev. Alexander Robb, one of the U. P. missionaries at Old Calabar. The following extract from a letter, dated Old Calabar, 1st December 1859, gives some details concerning it:—"I was at Creek Town yesterday, and received from 'King Eyo Honesty' a small bush animal; or, as the Krumen part of the word, and cannot say whether it arose from any habit peculiar to the animal. It lives in trees; but, being nocturnal, the people know exceedingly little about it. They cannot tell what it eats. A lad whom I asked said that *he* lived in the house, and *it* lived in the bush; how, then, could he know anything about it? My Krumen also recognised it as a countryman of theirs. They consider the one sent as a young one; and say that in their country it grows to the size of a common puss. Probably theirs is a different animal, but I cannot tell. They call it *Dwăn*, and say that it lays down the law to the other beasts, forbidding them to eat the young *fruit* when it begins to form on the trees. If the monkey transgress, the *Dwăn* seizes him, and holds him there till he dies,—yea, the monkey rots in his grasp. They say that they are shot together thus. If the monkey gets the shot, the *Dwăn* holds on; if the *Dwăn* gets the shot, they fall together. The Krumen say that the *Dwăn* eats fruit. This is all we know about it at present; and their (the Krumen's) account seems somewhat fabulous. One of the legs of this specimen is broken. I will send it by the mail that takes this to your address.—I am, &c., ALEXANDER ROBB.

"*P.S.*—Since writing the above, I have met a youth who professes to know about the *Angwántibo*. He says it sleeps by day, and eats at night; and that, when full grown, it is as big as an *old cat*, and that it eats fruit."

In a subsequent letter from Mr Robb, dated 28th February, 1860, he says:—"I trust you received the *Tardigradus* sent a few months ago. Another specimen which I procured I handed to Mr Thomson, who, I believe, sent it to Mr Murray."

I have also received from the Rev. H. M. Waddell the following notice, which he had put down in his note-book as descriptive of the "*Angwántibo*:—An animal of the sloth kind, lives in trees, hangs on the branches, and eats fruit. Rather larger, when full grown, than a large cat. Longish snout, short ears, each foot three long crooked toes and claws, with a thumb similarly shaped. No tail. Dun colour; cannot walk on the ground. When set down, crawls a little, falls over, and rolls itself up in a ball. Inoffensive."

character; at least, this *Angwántibo* seems to be somewhat intermediate in its characters between the first two subdivisions of the genus *Stenops* as given by Van der Hoeven, viz. —(*a*) *Tail short; index of hand very short, resembling an unarmed tubercle;* and—(*b*) *Tail very short.* The *Angwántibo* having the *index of hand very short, resembling an unarmed tubercle;* and also, the *tail very short.* To include this animal, the first character of section (*a*) would require to be altered to—*tail short, or very short; index of hand very short,* &c. It seems to me, indeed, from the discovery of this *Angwántibo* (assuming it to be a new species), that the greater or less length of the tail is not sufficiently distinctive to allow any characters taken simply from it to be used for the division into *sections* of the comprehensive genus *Stenops* of Van der Hoeven.

The generic character which Van der Hoeven gives of the GENUS *Stenops*—*index of hand short, not longer than pollex,* in the sections (*b*) and (*c*), or the equivalent GENERA *Nycticebus,* Geoff., and *Loris,* Geoff.—from the examination I have been able to make of these animals, appears to be due *to the smaller relative size of the metacarpal bone, and the phalanges of the index finger, which are* THREE *in number, as in all the other fingers* (*except the thumb*). In the *Potto,* however, and this *Angwántibo* (as will be afterwards described), which fall under his section (*a*), and the GENUS *Perodicticus,* Benn, the character of *index of hand very short, resembling an unarmed tubercle,* is due, not only *to the small relative size of the bones of that finger, but also to the presence of only* TWO *very small phalanges* (*the same number as in the thumb*), *the other fingers having three.* This anatomical difference forms a good distinction or character between section (*a*), the Genus *Perodicticus,* Benn., and the other Genera, which Van der Hoeven has also included in his great Genus *Stenops.*

The only species noticed by Van der Hoeven under section (*a*) of his genus *Stenops,* and, as far as I am aware, the only one known, is the *Stenops potto* or *Perodicticus Geoffroyi* of Bennett, and it, like this *Angwántibo,* is a native of Africa; the other described Genera, or species of Van der

Hoeven's Genus *Stenops*, are inhabitants of Asia, the East Indies, &c. Van der Hoeven, in his description of this species, the *Stenops potto* or *Aposou*, says—"The *Aposo* or *Aposou* of the negroes of the Gold Coast of Guinea is a nocturnal animal, which sleeps on trees and lives on fruits. The spinous processes of the last five cervical and of the first two dorsal vertebræ are long, and pierce through the hairy integument of the back, with a weak, horny covering. Professor Halbertsma first drew my attention to this peculiarity, which I have observed in two specimens."

On referring to the description of this same species (the *Potto*), placed under the Genus *Perodicticus*, and named *P. Geoffroyi*, by Mr E. T. Bennett, which is published in the "Proceedings of the Committee of Science of the Zoological Society of London," for 26th July 1831 (Part I, 1830–31). I find the animal now exhibited agrees with the general characters given there of the Genus (correcting the mistake of considering the projecting teeth in the front of the lower jaw as being all incisors, instead of both incisors and canines, according to the present view; and therefore the incisors only four in number, and not six, as Mr Bennett described them). To which I would add, as additional characters of the GENUS *Perodicticus*—tail short, or *very short;* index of hand very short, resembling an unarmed tubercle—*supported by small metacarpal bone, and only* TWO *small phalanges.* The *Angwántibo* seems to differ, tions of the body and limbs, which I shall afterwards notice in describing this specimen; and while at present unable to procure various works for reference, or a specimen of the *Potto* itself for examination, and therefore in want of more information on the subject, I am inclined to consider this specimen of the *Angwántibo* as being a mature individual, and probably forming another species of the same genus, and one that, so far as I am aware, has not before been described, I therefore, from the locality where it was found, give it provisionally the name of the *Stenops*, or *Perodicticus Calabarensis*.

The *Potto*, or *Perodicticus Geoffroyi*, is found at Sierra Leone, a region of the African coast, at some distance from Old Calabar. It is also known by a different name, being the *Aposo* or *Aposou* of the Gold Coast. The letters of the missionaries (from which extracts were given at the commencement of this communication) seem to indicate the possible existence of more than one species, probably of allied animals—the *Dwăn* of the Krumen, and this, the smaller *Angwántibo* of the natives of Old Calabar. Whether the *Dwăn* and the *Aposou* are the same, or different species, I am unable to determine: they probably bear a considerable resemblance to one another. From the great variety in size, however, of the animals referred to in these letters, I am at present inclined to believe there may probably be two, if not three, distinct species,—the *Aposou*, the *Dwăn*, and the *Angwántibo*,—the *Dwăn* being perhaps the largest in size.

Description of the ANGWÁNTIBO (from specimen in spirits:)—

Perodicticus Calabarensis (Mihi)—*above, yellowish-brown; the roots of hair dark gray; below, paler, in some parts nearly white; hair wool-like; length from muzzle to point of tail,* 10½ *inches; tail very short, (about* ¼*th of an inch in length).*

Proximal phalanges of both hands and feet (not including the pollex) united together by the integuments; the two distal phalanges being free.*

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* A hand of the *Potto*, figured in "Cuvier's Animal Kingdom"—London.

The *Angwántibo* is covered with a thick and long wool-like hair, which becomes short and thin on the face and on the extremities, the inner sides of the fore and hind hands being free from hair. The hair is of a dark gray colour at the base, and the upper third or so of its length is of a light brown or fawn colour, the terminal points being of a darker brown; this is the general character of the fur of the upper parts of the body and limbs. The face in front of the eyes is rather darker in colour, but the sides of the head are lighter, and the chin and throat are nearly white. The inner surface of the limbs is also lighter, as well as the whole under surface of the body, the gray hairs having their distal half of a light fawn colour, and in some places nearly white. The specimen having been for a long time preserved in spirits, makes it a little difficult to get at the minute details of colour. There are no stripes or markings on the back, or other parts of the body, to be observed on this animal, as on the *Stenops tardigradus* of the East Indies; its general appearance being more uniform over the surface, although somewhat mottled in character, from the hair varying in colour at base and apex.

The Body of the *Angwántibo* is slender, and measures 10½ inches in length from the point of the muzzle to the extremity of the very short tail, which is completely hid in the long fur of the body, and measures only about ¼th of an inch in length. This animal is a male; the penis, which is supported apparently by a small bone, projecting upwards and forwards from inches. The EYES are rather full and large, the opening of the lids measuring $\frac{1}{2}$ an inch in length ; the distance between the eyes at their anterior angles is $\frac{1}{2}$ an inch. They are rather prominent forwards, and very slightly lateral. The EARS are erect and patulous, rather large, and rounded in outline, without emarginations, measuring about $\frac{3}{4}$ths of an inch across from before backwards, and also from above downwards; they seem to be naked internally, and slightly covered with short hair externally. In this specimen they are nearly naked, especially on the inner surface. There are two transverse, abrupt, parallel, projecting ridges of cartilage, each measuring $\frac{4}{12}$ths of an inch in length, in the free cartilage above the external opening of the meatus. The external openings of the NOSTRILS are rather lateral, and are sinuous, curved upwards and inwards toward the mesian line of the full and rounded snout; and there is a groove between them, running down to the front of the upper lip. The TONGUE is long, and rounded in front, rather rough, being covered with small papillæ. Immediately below the tongue is the projecting lamina, covered with a horny cuticle, and resembling a smaller, bird-like tongue, which springs from the frenum and projects forwards, about $\frac{3}{8}$ths of an inch in length. It is free at its edges, and at its point, which projects about $\frac{1}{8}$th of an inch; reaching to within $\frac{1}{4}$th of an inch of the point of the tongue itself. This horny lamina measures about $\frac{1}{4}$th of an inch in breadth across its root or base, and about $\frac{1}{8}$th of an inch across its free or front extremity, which is divided into nine sharp terminal points or filaments. The *P. Geoffroyi* is described by Bennett as having this horny lamina terminating in about six filaments. It is difficult to understand the use of this strange supplementary horny, bird-like tongue, or expansion of the frenum, with its pointed terminal filaments, in an animal stated to feed on fruit; it would seem rather to be some sort of additional assistance towards capturing or killing an insect prey; but, in any view, its use seems to be very obscure. Below the tongue and this supplementary organ, the mucous membrane lining the floor of the mouth has a slightly free margin projecting along the sides of the gums of the lower jaw ; in which, apparently, the ducts of the submaxillary gland (Wharton's ducts) open into the mouth.

The NECK is rather short and slender. There is no appearance on the back of the neck in this specimen "of the spinous processes of the five last cervical and first dorsal vertebræ, piercing through the hairy integument of the back, with a weak horny covering," as described by Van der Hoeven of the *Stenops potto.*

The LIMBS are very slender, and nearly equal in length, the hinder extremities being a little larger and stronger in their development than the anterior. The FORE HANDS (see fig. 1 of the annexed careful drawings, nearly the size of life, for which I am indebted to my friend, T. Strethill Wright, M.D.) are thinly covered with short hair on the dorsal, and are bare of hair, or naked, on the palmar surface.

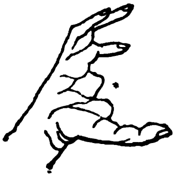

Fig. 1. Hand.

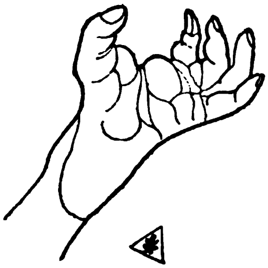

Fig. 2. Foot.

ANGWÁNTIBO.

rudimentary phalanges; each of the other fingers (not including the thumb), having *three.* This rudimentary index finger has no nail; there is simply a minute marking, like a cicatrix, or rather a mere short, depressed, smooth line, an indication of where a nail should be. The nails of the thumb and other fingers are all thin, flat, and rounded or ovate, like those of the human hand, and are not extended beyond the points of the fingers. The remaining three fingers are slender and prolonged, and the first phalanges are all conjoined by the integuments, the two distal phalanges of each finger alone being free. The index or second finger (considering the thumb as a finger) is, as already described, merely like a tubercle rising at the base of the others. The third finger is the smallest of the other three fingers, and also the shortest; the fourth (or middle of the developed fingers) is the longest; and the fifth, or last, is longer than the third. The hands are each divided into two opposing portions: the thumb, with the tubercle at its base, being opposed to the other fingers with the tubercle-like index at their base; the thumb itself being opposed to the fourth, the middle or longest of the fingers.

The *posterior hands* or *feet* (see fig. 2, which also shows the length of the tarsus) are rather larger and stronger than the anterior ones, and are each divided into two opposing portions; the one consisting of the thumb, with a large, rounded, fleshy tubercle projecting from the inner side of its base, as in the fore hand; and the other portion, formed of the remaining four fingers, the first phalanges of which are also conjoined, being covered by the integuments, as in the hand. There is a comparatively smaller fleshy tubercle, somewhat like the undeveloped index finger of the fore hand, projecting from the outer side of their base, which is opposed to the tubercle at the base of the thumb. It is not supported by any bone, but is merely a horny and fleshy projection like that on the base of the thumb. The nails of the thumb and fingers are thin, flat, and rounded or ovate in form, like those of the fore hand, with the exception of that of the second finger (counting the thumb as the first), which is narrow, convex, sharp-pointed, and claw-like, and extends nearly to the point of the third finger.

I subjoin details of the dentition of the *Angwántibo*; and also some of its admeasurements. For the relative measurements of the *Potto*, corresponding also to those already described of the *Angwántibo*, and showing their various differences, see Bennett's account of the GENUS *Perodicticus*, referred to already.

### DENTITION.

UPPER JAW:—

*Incisors* $\underline{2 \cdot 2}=4$. Two together (in pairs), with intermediate edentulous space,—*1st* incisor the smallest, the *2d* nearly twice as large as the first.

*Canines* $\underline{1-1}=2$. Large and projecting downwards. The intermaxillary suture is described as being immediately in front of the corresponding teeth of the *Potto;* these teeth are therefore undoubtedly canines, and when the mouth is shut, they pass immediately behind the small canines which project forwards alongside the incisors of the lower jaw.

*Molars* $\underline{6 \cdot 6}=12$.

(False Molars, 3.) *1st*, smallest, conical; with very small and slight indication of an internal conical tubercle: *2d*, conical; with small internal conical tubercle: *3d*, with external conical tubercle; and smaller, shorter, internal tubercle.

(True Molars, 3.) *4th*, with two external conical tubercles; and two internal smaller and flatter tubercles: *5th*, two external conical tubercles; and two internal, smaller and flatter ones: *6th*, two external conical tubercles; and one internal flattened and smaller tubercle.

LOWER JAW:—

*Incisors* $\overline{2 \cdot 2}=4$. In pairs laid closely together, the pair appearing like one tooth, and all sloping forwards.

*Canines* $\overline{1 \cdot 1}=2$. Small, sloping forwards adjoining incisors, which they closely resemble. Each tooth, however, is slightly larger in size than a pair of the incisors.

*Molars* $\overline{6 \cdot 6}=12$.

(False, 3.) *1st*, large, conical, projecting forwards and upwards like a canine tooth in shape (the corresponding tooth in the *Potto* was formerly described as a canine tooth). When the teeth are closed, however, the canine of the upper jaw passes in front of this tooth, it is therefore the first molar; *2d,* smaller than first, shorter, conical, and pointed forwards; *3d,* rather larger than second, conical.

(True, 3.) *4th,* two external and two internal tubercles, nearly equal in size; the internal rather the largest; *5th,* two external; and two internal and rather larger tubercles; *6th,* two external; and two internal tubercles, nearly equal, and less defined; with another smaller tubercle behind.

$$\begin{array}{ccc} \text{Incisors.} & \text{Canines.} & \text{Molars.} \\ \frac{2\cdot2}{2\cdot2}=\frac{4}{4}; & \frac{1\cdot1}{1\cdot1}=\frac{2}{2}; & \frac{6\cdot6}{6\cdot6}=\frac{12}{12}=\frac{18}{18}=36. \end{array}$$

*Length of Body,* from muzzle to point of tail, 10½ inches; tail, ¼ an inch, including fur, ½ an inch.

ANTERIOR LIMBS:—

*Length of Arm* 2¼ inches; *Fore-Arm,* not including hand, 2¼ inches.

*Hand.*—The first phalanges of the fingers are covered and conjoined by the integuments of the hand, the two distal bones being the only ones that are free; length from wrist to point of fourth or longest finger, 1¼ inch.

*Length of Thumb, or First Finger,* from wrist, ¾ths of an inch: of this, there is a free extremity of ½ an inch in length.

*Length of Index or Second Finger.*—Metacarpal bone of index finger measures $\frac{3}{12}$ths of an inch in length. The first phalanx measures $\frac{2}{12}$ths of an inch, and the distal phalanx $\frac{1}{12}$th of an inch in length; the metacarpal bone of index inch; and the third about $\frac{3}{16}$ths of an inch. Free extremity $\frac{3}{8}$ths of an inch.

SPAN, 1 inch and $\frac{8}{10}$ths of an inch.

POSTERIOR LIMBS:—

*Length of Thigh*, 2½ inches; *of Leg*, 2½ inches.

*Foot*, from ankle-joint to point of longest finger or toe—the fourth, 1½ inch. *Tarsus*, not elongated, about ½ an inch in length. *Metatarsal bones* measure from $\frac{5}{16}$ths to $\frac{6}{16}$ths of an inch in length.

The first phalanges (with the exception of the thumb), like those of the hand, are conjoined together.

*Thumb or First Finger.*—Thumb with metatarsal bone, about $\frac{7}{8}$ths of an inch long. First phalanx, $\frac{6}{16}$ths of an inch; second, $\frac{4}{16}$ths of an inch.

*Length of Second Finger*, 1 inch; first phalanx, nearly $\frac{3}{8}$ths of an inch; second phalanx, $\frac{3}{16}$ths of an inch; third phalanx, bone of claw, $\frac{4}{16}$ths of an inch; claw itself, $\frac{3}{16}$ths of an inch. Free extremity, ½ an inch.

*Length of Third Finger*, first phalanx, $\frac{7}{16}$ths of an inch; second phalanx, $\frac{4}{16}$ths of an inch; third phalanx, $\frac{3}{16}$ths of an inch; third finger smaller than the fifth, and free about $\frac{3}{8}$ths of an inch.

*Length of Fourth Finger*, first phalanx, $\frac{4}{8}$ths of an inch; second phalanx, $\frac{3}{8}$ths of an inch; third phalanx, $\frac{3}{16}$ths of an inch; fourth finger longest, free about ½ an inch.

*Length of Fifth Finger*, first phalanx, $\frac{4}{16}$ths of an inch; second phalanx, $\frac{5}{16}$ths of an inch; third phalanx, nearly $\frac{3}{16}$ths of an inch. Larger than third finger, being intermediate between it and the fourth, and free for about $\frac{3}{8}$ths of an inch.

SPAN measures nearly 2 inches in length.

This animal possesses a clavicle. The stomach is moderate in size, and rounded in form, and contained what seemed to be digested vegetable matters. It has a large sacculated cœcum of about 1¾ths inch in length.

MICROSCOPIC STRUCTURE OF THE HAIR OF ANGWÁNTIBO.—

It occurred to me to examine through the microscope some of the hairs of this little animal; and I was much struck by their

Mr Carruthers says:—"It is certainly a *second* species of *Perodicticus*. I compared it with two stuffed specimens of the *Potto*, and, with the assistance of Dr Gray, determined that it was *new*, differing chiefly from *P. Geoffroyi* in its tubercle-like tail and large ears. I also got Mr Bennett's specimen of the *Potto*,—which is yet fortunately in spirits,—and have been able more completely to discriminate the differences."

At my desire, Mr Carruthers got an artist to make sketches of the head of Mr Bennett's specimen of the *Potto*, and also of my specimen of the *Angwántibo*, to show the various differences between them, in a more manifest way than by any lengthened description; and as both the specimens have been preserved in spirits, these comparative differences

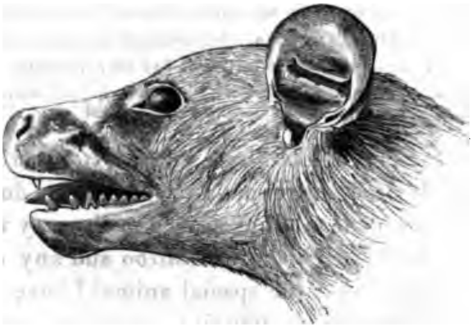

Fig. 3. Head of Angwántibo

are seen at a glance, no change in the original appear-

In pointing out the various specific differences which the comparison of the two specimens make manifest, Mr Carruthers says, in the *Angwántibo* the body and limbs are more slender than in the *Potto*, and the colour of the hair is more uniform. The head is longer and narrower, with a more produced muzzle, larger mouth, and more prominent eyes; while in the *Potto* (see woodcut), the head is nearly round, and has a much less projecting muzzle. Again, the ear is larger, and directed more upwards and forwards in the *Angwántibo;* and there are two folds, as already pointed out, in the inner surface of the ear; while there is only one in the *Potto*. The drawings show also the remarkable differences in the teeth. The teeth in the lower jaw, which Bennett described as the canines in the *Potto*, but which are now considered as pre-molars, are mentioned by him as having cutting surfaces, both before and behind, they are, in fact, small, flat, triangular teeth; whereas in the *Angwántibo* they are long, rounded, and more canine-looking. Then the six teeth in the front of the lower jaw, in the *Angwántibo*, are small and hyaline, not visible above the under lip; while in the *Potto* they are large, prominent, and projecting (see woodcuts), and of the same colour as the molars.

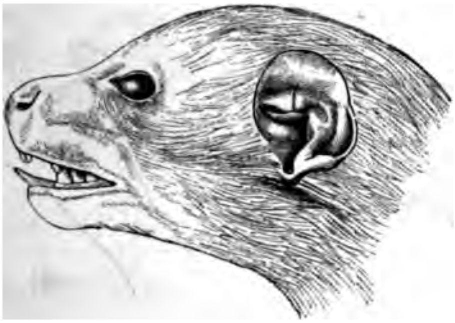

Fig. 4. Head of Potto.

There is also a very striking difference in the hands of the two little animals. Mr Carruthers has been good enough to make the annexed careful sketches, the size of life, of the hand (fig. 5), and the foot (fig. 6), both belonging to the left side, of Mr Bennett's specimen of the *Potto*, (see woodcut, figs. 5, 6); and on comparing these sketches with those already given of the *Angwántibo*, which, for comparison, I here repeat (figs. 1, 2), the differences will be seen more clearly than could be brought out by any description. In the *Angwántibo* the hands and feet are small, round, and fleshy, with several large pads; in the *Potto* they are large, flat, and thin. In both, as has been already carefully described, the index fingers of the fore hands are undeveloped; being represented in the *Angwántibo* by a simple tubercle (see * fig. 1.) In the *Potto*, however, as shown in the drawing, the index is not so like a mere tubercle, but is more developed, and therefore more resembling a finger, than in the *Angwántibo*, (See * fig. 5.)

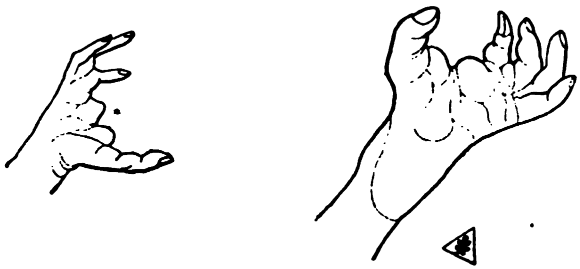

Fig. 1. Hand. Fig. 2. Foot.

ANGWÁNTIBO.

lished on the *Potto.* Bosman's figure is a grotesque caricature of a fat and lazy animal, having a very faint resemblance to the *Potto.* Van der Hoeven gives a drawing of the skull in the "Tydschrift voor Nat. Gesch.," vol. ii. plate i. fig. 3, and of a young animal, in plate ii.; also a very full account, with drawings of an adult, and of the skeleton, brain, and viscera, in a paper in Verhand. der Eerste Klasse van het Kon. Med. Inst. IV. 1851. More recently, in 1856, Dahlboum, in his "Studia Zoologica," gives a figure and description of the *Potto.* He divides the *Lemuridæ* into three sections. First, the true *Lemurs,* with long tails; second, the *Lorids* (stenops), without tails, and with long limbs; and third, those with very short tails, or almost tail-less, oval or globose heads, and short fleshy arms. Here he has two genera: I. *Perodicticus,* characterised thus: "Caput ovale, ore crasso obtuso. Aures liberæ. Oculi subparvi. Index manus anticæ abortus, in tuberculum coarctatus." And, II. *Nycticebus,* "Caput globosum, ore conico. Aures in pelle absconditæ occuli magni. Digiti normales."

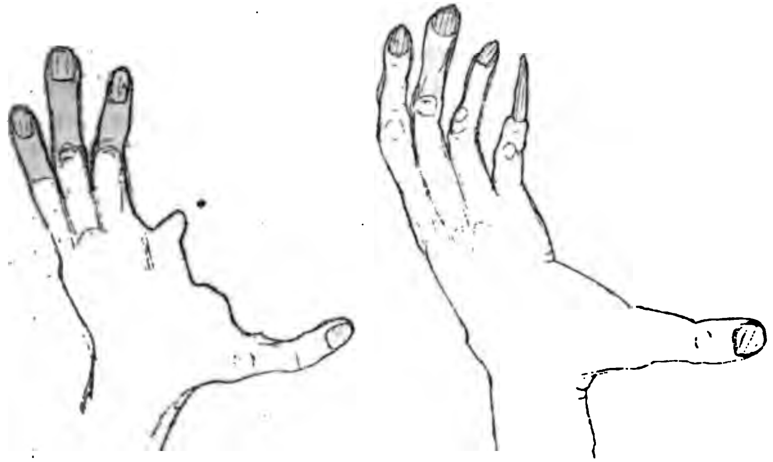

Fig. 5. Hand. Fig. 6. Foot.

POTTO.

I may mention, in conclusion, that I find, since this paper was in type, that Van der Hoeven made a short communication on the *Potto* to the Meeting of the British Association in 1850, and a second on the anatomy of the *Potto* in 1860, in which he refers to a complete monograph of this animal published by him in 1859, in the seventh volume of the Transactions of the Royal Academy of Sciences of the Netherlands (Ortleedkundig Ondersock van der Potto van Bosman door F. A. W. Van Campen Med. Cand. Uit due Platen Amsterdam. 4to, 77 pp.) Van der Hoeven also details his arrangement of the *Lemuridæ*, published in his "Handbook of Zoology," and refers again to the peculiarity in the *Potto*, "that some of the spinous processes of the neck, covered only by a thin corneous epiderm, pierce through the fur-like prickles. They are those of the fifth to the last cervical, and of the first two dorsal vertebræ." These projecting processes are evident, Mr Carruthers informs me, in Mr Bennett's specimen, though, probably from its youth, neither so numerous nor so strongly marked as Van der Hoeven describes them. In the two *stuffed* specimens in the British Museum they cannot be detected, as might have been expected; as already stated, I could not detect this peculiarity in my specimen of the *Angwántibo*.

I have been recently favoured with the following explanation of the name *Angwántibo*, from the Rev. Alexander Robb:—"The name *Angwá-ntibo* is compound; the first part is the same as the name of the domestic cat, which the Calabar people call *Angwá*, or *Angwá-mbána*—the *ng* being a very soft nasal sound. *Angwá* is probably onomatopoetic, from its

*Wednesday, 9th May.*—T. STRETHILL WRIGHT, M.D., President, in the Chair.

Various Committees were appointed for conducting special investigations during the recess.

Mr George Logan reported that, in accordance with the remit of last meeting, the Committee on Marine Zoology had prepared and forwarded a memorial to the Lord Advocate, praying that certain exceptions be granted on behalf of scientific societies, from the restrictions in the proposed New Herring Fishery Bill. He stated that he had received a reply, mentioning that due weight would be given to the prayer of the memorial.

The following donations to the Library were laid on the table, and thanks voted to the donors:—

Transactions of Royal Society of Edinburgh, Vol. XXII., Part I., 4to; Proceedings of the Royal Society of Edinburgh, 1858–59, 8vo.—From the Society. Proceedings of the Zoological Society of London, 1859. Part III. July to December.—From the Society. Board of Science, Second Annual Report (Gold Fields), 1859–60, Victoria; presented to both Houses of Parliament by his Excellency's command.—From David Page, Esq. De la Formation et de la Fécondation des Œufs chez les Vers Nématodes. Par Edouard Claparede. Geneve, 1859. 4to.—Zur Morphologie der Zusammengesetzten Augen bei den Arthropoden, Von Dr Edouard Claparede in Genf.—From the Author.

The following Communications were read:—

### I. *Observations on British Zoophytes.* By T. STRETHILL WRIGHT, M.D.

### *On Halcampa Fultoni* (Strethill Wright), a parasitic Actinia.

The author stated that, in the summer of 1858, he took, by dipping, a great number of Medusæ of the genus Thaumantias, off Granton Pier. To the peduncle of one of these was attached a small Actinia, about half an inch in length, and one-eighth of an inch in diameter. From its general appearance, he considered it to be a young specimen of *Actinia troglodytes,* which had been seized by the Medusa, dragged from its native mud, and brought captive to the surface of the water; but it was unfortunately lost before he could examine it carefully. In June, his friend, Mr Fulton of Granton Pier, brought him some specimens of Thaumantias, to one of which another Actinia, of the same species as the one he had before observed, had attached itself by swallowing the peduncle of the medusa. The body of this Actinia was of a transparent, yellowish-white colour, and marked by twelve paler lines, indicating the situation of the longitudinal septa within. The oral disc was oval, and formed by facility and assistance in the work of excavation. A great number of specimens had been obtained in beautiful preservation, as could be seen from those exhibited to the Society, and geologists might rest assured that every care would be taken to render these treasures available to the purposes of science.* Independent of the palæontological value of so many new and perfect forms, the discovery was of high lithological interest, as enabling geologists to determine with greater precision the relative ages of the Forfarshire and Caithness series, both of which had now been proved to be characterised by the same specific forms.

### III. *On the Nidus and Young of* Pontobdella muricata, *and other Annelides.*

By Chas. William Peach, Esq., Wick. (With Illustrative Sketches.)

On the 21st January 1859, my colleague, Collector Boyd, kindly sent me an old oyster shell attached to an oyster, brought to him from the Frith of Forth, on which he had observed something strange and unusual. The form was quite new to me, and although well acquainted with the nests of many shells and other sea animals, this differed from all I had previously seen. I found amongst the nests a small annelid, and, on applying my lens, discovered that it was a young *Pontobdella*, which I supposed had got in there for shelter. I laid it carefully aside, and continued my examination, and soon found a portion of a second worm protruding from the upper part of *della.* Here, then, was a discovery! The Pontobdella is so well known as a parasite on skate and other fishes, that I need not describe it. Remembering how little was really known about the propagation and early forms of annelides, and of the conflicting opinions entertained by various naturalists on the subject, I felt quite delighted,—some believing that all pass through many changes, from the egg to the adult state; others that there is no change. The tale of the "two travellers" came into my mind, "both are right and both are wrong," and that at any rate an opportunity was afforded me, if appealed to as an umpire, to decide *satisfactorily* one point in the controversy,—namely, that beyond that of growth, the Pontobdella passes *through no change after leaving the egg.* The nests are darkish gray, stout and tough, balloon-shaped, are deposited in a group, but not in mathematical order. Although one showed a worm protruding from the top, this was caused by the accidental rupture of the egg; the natural opening for the escape of the young is a circular opening on the side. Each nest contains one worm. The shell having been long out of the water, all the worms were dead, but in a good state of preservation; they, with many of the nests, are in spirits, and only await the time when some one will demand them for publication, in the long desiderated history of these beautiful, but too long neglected creatures. Having given my decision for the *no-change man,* I must now turn and side with those *who assert change.* From having read many of the papers, and seen the figures both of the adult and early stages of annelides, by the late Dr George Johnston, and of others published in various volumes of the "Magazine of Natural History" (unfortunately few of these volumes have come in my way), and as well from observations of my own, "On the luminosity of the sea," published in the "Transactions of the Royal Institution of Cornwall for 1849 and 1850," where I figured two forms of the young of annelides which came under my notice during my researches on that subject, as well in 1844, when I first discovered the *Nereis bilineata,* as a tenant of the same shell with the hermit crab,—*Pagurus bernhardus,*—I saw the eggs of this Nereis extended, and afterwards sheltering under the appendages on each side of its really beautiful parent. Of the parentage of these eggs there is no doubt; but beyond that all else about them to me is dark. I also regret I must leave those figured at 6 and 7 (sketch exhibited) in the position of those "whom many fathers share," from not being able to affiliate them. The one figured at 6 occurred to me both at Fowey, in Cornwall, and at Peterhead, in Aberdeenshire. At the expense, I fear, of being tiresome, I cannot resist the opportunity of adding, that in the course of my turning up the stones between tide-marks, after the nests of *Lamellaria tentaculata,* in March 1852, at Wick, I observed bluish masses of jelly-like matter, in which light yellowish spots showed through the transparent envelope. At first I took them for masses of ova of shell, or Nudibranchs; but on examining one carefully, I observed that at each end of the elongated mass there was a hole, and I fancied I could see something move in it. On passing my knife under it, a small dark, olive-green, iridescent worm, eel-like, glided out. This I secured, and found it to be one of the *Nemertes,* probably *N. gracilis,* so abundant under stones, where black, decomposing vegetable matter is mingled with sand. From year to year ever since I have noticed these jelly-like masses, with the attendant worms. Last night (3d May 1860), I found five or six nests of them under one stone, and as they were farther advanced than those I first found, instead of the *Nemertes* being in the centre of the mass, they lay either close alongside of it, or partly with Dr M'Bain, dredged up the nests of Pontobdella in the Firth of Forth. Sir J. Dalzell had figured these nests and the young in his "Powers of the Creator," vol. ii. plate 1, and well described them in that work. Referring to Mr Peach's description of the Nidus of *Numertes gracilis*, Dr Wright stated that the nests of several annelides might be found in the pools near Seafield, the eggs of which had been hatched under his care, and he described the progress of development in the embryo. He stated that at one stage the embryo of the annelid exactly resembled that of *Cydippe pomiformis*, formerly described by him to the Society.

## IV.—*Notice of Snakes and Lizards from Old Calabar.* By GEORGE LOGAN, Esq., W.S.

During the year 1857, the missionaries in Old Calabar connected with the United Presbyterian Church in Scotland, transmitted to some of the Fellows of the Royal Physical Society a considerable number of specimens of snakes and lizards, and of other interesting objects in various departments of natural history. Of the reptiles a portion were sent to Dr J. E. Gray, of the Zoological Section of the British Museum, with a request that he would examine and name them, that they might be described and submitted to this Society; and if there were any duplicates among them which would be of service to the Museum, they might be retained. Dr Gray acknowledged receipt of the specimens transmitted to him, but he seems to have overlooked or forgotten the conditions attached to their transmission, as in the spring of last year (1859) he, upon personal application at the Museum, only returned six of them named, without any notice of the remainder. He was then written to, reminding him of the terms upon which the reptiles were sent to him, and that it was desirable that a list and description of them should be submitted to this Society, but no answer was received to this communication. The British Museum Catalogue, and the Proceedings of the Zoological Society of London, have furnished, however, to some extent the information awanting. The following notice by Dr Gray appears in these Proceedings, Part xxii., March 1858, page 154:—"Mr Logan kindly sent to me for examination a number of snakes and other reptiles which had been collected by the missionaries in Old Calabar. Among several very interesting species I observed a new genus of the family *Boidæ*, which I have great pleasure in laying before the Society, more especially as it appears to be the indication of a new tribe in that curious family.

"This animal belongs to the second section of the family which is thus characterised:—

"*II. Tail very short, not, or only very slightly, prehensile. Head indistinct, short.*

"It is entirely distinct from the tribes *Cylindrophina*, *Carinina*, and *Tortricina*, and therefore I propose to form for it a tribe (*Calabarina*) by itself, having the same characters as the genus.

"*Calabaria.*

"Head small, short, rounded in front, the same size as the body; muzzle depressed, rounded; labial shields flat, $\frac{8-8}{9-9}$; the hinder small, front moderate; rostral shield high, large, triangular; frontal shields, three pairs, band-like, subsimilar, followed by a band-like shield continued from side to side, which has behind it a small subtrigonal shield on each side, with a central large triangular shield between them on the crown. Eyes surrounded by scales, on the upper edges of the upper labial shields, and the outer edges of the fourth and fifth frontal plates, and with one ocular shield in front, and one band; and then the head shields will lie thus:—three pair of band-like frontal, two smaller triangular superciliary shields over each eye, having in the middle between them two triangular parietal shields.

" *Calabaria Fusca* (pl. xiv.)

"Dark brown, some of the scales yellowish, scattered singly or in groups on the back and sides; ventral shields grayish. Sides of the belly with a few unequal yellow spots.

"Length, 36 inches; diameter, 1 inch. *Hab.* Old Calabar, West Africa. (*Geo. Logan, Esq.*)

"Since this paper was read, I have discovered a young specimen of this boa among the specimens from the Zoological Society, which they had received from Fernando Po. It is about half the length and diameter of the specimen from Old Calabar. It has the head shields more uniform, and as I supposed they might be when I described that specimen. It has three pairs of band-like frontal shields over the forehead, a rather large parietal shield behind them on the crown of the head, and two small subequal superciliary shields between the outer edge of the parietal and the eye, on each side a narrow transverse band-like central shield behind, and rather broader than the parietal shield, with a small scale-like shield, like those on the neck behind, and on the sides of it."

Although the above descriptions have thus already appeared in the proceedings of another Society, there has been no hesitation in fully quoting them, not perhaps because they ought rightfully to have first been given in the Proceedings of this Society, but that they are of sufficient interest to entitle them to repetition.

Of the other specimens of reptiles returned by Dr Gray, that labelled *Ahætulla Chenonii* will be found noticed in a most useful list prepared by him, at p. 161 of the above-mentioned part of the Zoological Society's Proceedings, No. 68 of the list, under the leading name of *Ahætulla Irregularis*, together with its synonyms; the localities assigned being Gambia, Fantee, and the Gold Coast. Another of the specimens will be found noticed in the same list, immediately following, under the name *Ahætulla Smaragdina*, together with its synonyms, the localities assigned being Ashantee and Guinea. The next specimen, ***Causus Rhombeatus***, will also be found in Dr Gray's list, p. 163, No. 86, with its synonyms (*Hab.* West Africa; Gold Coast, Liberia, South Africa); but it is more fully described in the catalogue of reptiles of the British Museum, 1844 (Snakes, p. 33). Of this snake the British Museum possesses four. The specimen named ***Boodon Geometricus*** will be found, with its synonyms, in Dr Gray's list, p. 159, No. 42, under the name *Boædon Geometricus*, *Hab.* West Africa; and the specimen named *Onychocephalus Liberianus* will be found with the single synonym *Onychocephalus Liberiensis*, under the name *Onychopsis Liberiensis*, in Dr Gray's list, p. 157, No. 18; *Hab.* Liberia, Calabar.

The last remaining specimen to be noticed is a lizard, *Tiliqua Fernandii*, described in the British Museum Catalogue (p. 110, Lizards) as *Tiliqua Fernandi*—the Fernando Po Tiliqua—of which an interesting account has already been given to this Society in a paper by Mr Andrew Murray, at p. 415 of the first volume of its Proceedings. The oblique cross brown bands along the brown sides should be bright scarlet or vermilion, but stuffed or preserved specimens seem to lose this brilliant colour, as it is not to be seen in the present specimen, although otherwise in excellent preservation.

## V. *On the Silicification of Organic Bodies.* By ALEXANDER BRYSON, Esq., F.R.S.E.

stance of the animal, or the organic matter contained in the shell, and that where such organic substance is not present there, no silicifying takes place. In support of these views of Von Buch, it may be remarked, that wherever shells are found embedded in a silicious matrix, they are generally entirely converted into silica, no doubt owing to the large quantity of animal matter contained in them before silicification took place. In no instance could I find a trace of calcareous matter remaining, clearly showing that either a chemical change had taken place, or a mechanical substitution of the silica for the whole calcareous matter.

In further proof of Von Buch's theory, I may quote a paper by Dr Bowerbank on a zoophyte (*Alcyonites parasiticum*) which he found enclosed in an agate. The interest attached to this paper is, that while we have no evidence of the time required for the silicification of calcareous bodies, and of woods and horny substances here, we have complete evidence of the rapidity of the change from the slight amount of the decomposition of so tender a zoophyte as an *Alcyonium.* On this point Dr Bowerbank remarks, "Nearly the whole of the animal within the agate is in a beautiful state of preservation, but there are a few spots which present evidence of the commencement of decomposition by the detachment of groups of cells from the mass of the polypidom; in these cases the remains of the tentacles, as might be expected, are very rarely to be seen, and the disrupted mass is totally without a sponge fibre. The envelopment of a tooth, or of hard calcareous bodies, such as shells, afford no definite information regarding the time necessary to accomplish such an operation. The investment even of such bodies as the rigid endurable horny fibres of that tribe of sponges which are usually to be observed embedded in flint, cherts, and moss agates gives also a considerable range of time to accomplish the fossilisation; but when we see such a soft and perishable substance as the fleshy body of the living *Alcyonidæ*, and such delicate organs as the tentacula of the polypes thus preserved with such evident appearances of freshness and perfection, I own it excites in me the greatest astonishment that there should have been so rapid a deposit of silicious matter as must evidently have taken place process of silicification considerable ruptures of the vessels had taken place, and that the wood was in a recent state at the time of fossilisation. I may further state, that the late Robert Brown showed me a section of silicified wood which fully corroborated the reasoning of Dr Bowerbank, as it bore distinct evidence of having been alive, and struggling to live, during the process of silicification. That the solution of silica in the humid way was not so difficult as many geologists supposed, chemists' experiments all tend to prove that it is soluble in a large degree. I especially refer to the experiments of De la Rue, who succeeded in obtaining minute crystals of quartz by an aqueous method. De la Rue found that the gaseous body, fluoride of silicon ($Si F_3$), is decomposed by contact with water, one-third of the silicic acid being deposited in the form of jelly and silicated hydrofluoric acid ($3HF + 2SiF_3$) produced : thus, $3 (SiF_3 + 3 (HO) = SiO_3$ (which deposits) $+ 3HF + 2SiF3$ (which remains in solution).

The deposited silica is extremely soluble in water, and he observed that the silicated-hydrofluoric acid always retains a portion of uncombined silicic acid in solution, which deposits after the lapse of some months in minute crystals of artificial quartz. It thus appears that water is the solvent of the silica, which, when recently produced or separated from its combinations by the action of the atmosphere on the earthy silicates, is presented in the modification most favourable for solution. The conclusions to be drawn from these experiments simplify very much our ideas of the silicification of wood shells and other organic bodies. Geologists hitherto have sought the explanation of the phenomena of petrifaction in the action of intense heat aided by pressure. It is clear, however, from the facts adduced by Dr Bowerbank, that such agencies could not have obtained during the silicification of his *Alcyonium ;* and further, it appears from the preservation of the most minute tissues in fossil woods, that pressure and extreme heat could not have been present.

With regard to the preservation of the minute tissues in various fossil woods, especially the pines and araucarians, as shown in their radial sections, I had always found a difficulty in accounting for their preservation on any hypothesis, until an accidental phenomenon enabled me satisfactorily to account for it.

While preparing chloride of gold, I had occasion to expose to the action of nitro-muriatic acid many small articles of jewellery which had been chased and variously fashioned. After exposing them for many hours in the usual bath at the proper temperature, I was astonished to find that none of the articles had changed either in shape or size, although the solution showed the proper quantity of gold had been dissolved. After decanting the acid, and washing well the jewellery with distilled water, and again adding a fresh quantity of aqua regia, I found that no further portions of gold were dissolved, but that the articles still retained their form and size. Some of the rings, which were chased in high relief, exhibited, as when put into the flask, every mark of the workman's tool. The mystery was soon unriddled; the jewellery had all been alloyed largely with silver, every atom of which had been changed into a chloride, and as each atom of gold was dissolved, it was replaced by an atom of the worn silver, and so the form of each article was retained as when first put into the flask. On analysis, it was found that no particle of gold was left—all was converted into chloride of silver. This fortunate experiment at once enabled me to perceive, that when a ligneous atom was removed from a fossilising tree, an atom of silica was deposited, and hence the perfection with which the most minute structure was preserved.

# APPENDIX.

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## *Description of the Bones found in a "Pict's House" in the Island of Harris. Being Notes to Communication read 22d February* 1860. By JAMES M'BAIN, M.D., R.N.

The first fragment is a portion of the right side of the upper jaw of a dog of tolerably large size, with a part of the molar bone attached; the sectorial tooth and first tuberculated permanent molar remain *in situ;* and there are sockets for the second and third premolars in front, with a socket for the last true molar behind. The sectorial tooth in the upper jaw of the *Canidæ* is preceded by a deciduous tooth, and is therefore a premolar. The foramena present in this fragment are the inferior orbital foramen, the lachrymal canal, the spheno-palatine foramen for transmitting nerves and vessels to the nasal fossæ, and a slightly developed palato-maxillary canal. The next specimen also belongs to the dog, and is a part of the left lower jaw; it corresponds in size with the portion of the upper jaw just described, and probably belonged to the same individual—it contains the last premolar, the sectorial tooth, the second true molar, and a socket for the third and last permanent molar. The sectorial tooth in the lower jaw is not preceded by a milk tooth as in the upper jaw, and is in fact the first true molar. The dental formula of the *Canidæ* is $i\,\frac{3-3}{3-3}\,c\,\frac{1-1}{1-1}\,pm\,\frac{4-4}{4-4}\,m\,\frac{2-2}{3-3}=42$. The depression formed by the Masseter muscle in the lower jaw of the dog does not extend to the under edge of the bone as it does in the fox, and would enable the comparative anatomist to distinguish to which of the species this fragment of the lower jaw belonged. The third specimen is the left tympanic bulla of the common seal (*Calocephalus vitulinus*), broken off at the fissure that divides the bulla from the mastoid process. The mastoid process is very slightly developed in the section of the *Phocidæ* to which the *Calocephalus vitulinus* belongs, and seems to form a part of the osseous bulla. The fourth fragment is the basal portion of a horn of the red deer (*Cervus elephas*), with a part of the brow antler cut and fashioned by a sharp instrument. The fifth piece is a branchlet of the same species, cut and hacked apparently for the purpose of breaking it from the stem. The sixth fragment is a small bit of bone, evidently a portion of a lesser branchlet, which is also cut and polished. The seventh specimen is a portion of the left side of the lower jaw of the *Bos longifrons*, and contains the second and third deciduous molars and first permanent molar. The third deciduous molar has three large vertical columns, each with an inner and outer acute summit, the inner summits rising higher than the outer. There are two accessory columns, one on each side of the outer surface of the large middle column, extending upwards to the base of its summit, with distinct concentric layers of *crusta petrosa*, enamel, and central dentine. This three-columned deciduous tooth is known to be succeeded, between the second and third year, by a permanent premolar with only two columns. The loose teeth also belong to *Bos longifrons ;* the tooth marked No. 8 is the first true molar on the right side of the upper jaw; No. 9 is the last permanent molar on the left side; No. 10 is a third deciduous premolar on the right side; No. 11 is the second deciduous premolar, also on the right side, and all belonging to the upper jaw. The larger column in these deciduous premolars is [redacted] extremity and the first premolar socket. There is a slight metallic crust on the inner surface of the teeth, very distinct on the third tri-columnar premolar. The remaining fragment in this collection, No. 15, is the upper half or nearly two-thirds of the right middle metacarpal or cannon bone of a small-sized *horse*, from which the upper articulating surface is separated; the canal for the medullary vessels is recurrent, and placed close to the outer edge of the groove for the internal splint bone. The fore cannon bone in the horse is more flattened in an antero-posterior direction than it is in the hinder extremity, as in the latter it is somewhat compressed at the sides, and more rounded.

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# PROCEEDINGS

OF THE

# ROYAL PHYSICAL SOCIETY.

## NINETIETH SESSION, 1860-61.

*Wednesday, November* 28, 1860.—WILLIAM RHIND, Esq., President, in the Chair.

Mr Colin S. Valentine, medical missionary, Dispensary, 39 Cowgate, was balloted for, and elected a non-resident member of the Society.

The following donations to the Library were laid on the table, and thanks voted to the donors:—

1. Proceedings of the Literary and Philosophical Society of Liverpool, for Session 1859–60, No. 14.—From the Society. 2. Canadian Journal, Toronto, Nos. 27 and 28, for May and July 1860.—From the Canadian Institute, Toronto. 3. Proceedings of the Royal Institution of Great Britain, Part x., November 1859–July 1860; London.—From the Royal Institution of Great Britain. 4. Proceedings of the Zoological Society of London, 1860, Part i., January–March; Part ii., March–June.—From the Society. 5. Memoirs of the Literary and Philosophical Society of Manchester, Second Series, Vol. xv., Part ii., 1860. 6. Proceedings of the Literary and Philosophical Society of Manchester, 1858–59, No. 1.—From the Society.

WILLIAM RHIND, Esq., President, then delivered the Opening Address:—

GENTLEMEN,—I have to congratulate the Society this evening on again assembling to commence another session, and with the prospect of having this session filled up with a series of as interesting and instructive communications as characterised the one that is past.

On this occasion the congratulations to the meeting would be unalloyed, were it not that we have to deplore the loss of one of our office-bearers, whose punctual presence here, not [illegible] on all occasions, was always [illegible] hailed with pleasure and confidence. [illegible] the universal feeling of the [illegible] of Mr William Oliphant, the Society has sustained a loss which will be [illegible] cannot readily be replaced, while [illegible] to mourn the loss of a personal friend. [illegible] liberally educated, and at first intended for one of the learned professions, the naturally delicate state of Mr Oliphant's constitution prevented him from prosecuting his original intention; but he still chose a walk of life which gave scope to his love of and desire for knowledge, and as a publisher he became the successful diffuser, as well as in several instances the patron and kind friend, of those engaged in the pursuit of literature and science. Mr Oliphant became a member of the Royal Physical Society in August 1828, and was thus in connection with it for a period of thirty-two years. A few years after his entrance, he was requested to undertake the duties of occasional secretary, and from 1844 to 1849 he acted as secretary. For the last ten years, as you all know, he fulfilled the duties of treasurer. Under all the phases which this Society has passed through, from the period mentioned,—in its prosperity, in its difficulties, in its temporary decline, and again in its complete revival,—Mr Oliphant tenderly nursed it, husbanded its funds, preserved its library, and found for the Society this

Mr Oliphant. You are all aware, too, what an interest Mr Oliphant took in our scientific pursuits, and that it was through him, in the first instance, that an introduction was obtained to the Calabar missionaries, whose contributions to the zoology of Western Africa have afforded so many interesting communications.

During the recess, another and venerable member of our Society has also paid the debt of nature,—Mr Alexander Rose, long a well-known lecturer on geology and mineralogy in this city, who, as often as the growing infirmities of a good old age would permit, was always a welcome and respected member among us. Mr Rose, a native of Dingwall, Ross-shire, not far removed from the birth-place of another of our late lamented and celebrated associates, Mr Hugh Miller, was also, like him, a self-taught geologist and man of science—if it may not be said that every man of science is, in a great measure, self-taught. Mr Rose in early life became a citizen of Edinburgh; and, after some years, relinquishing an art in which he was both expert and ingenious,* he resolved to follow the irresistible bent of his taste and inclinations, and in time became a celebrated practical mineralogist and geologist, He, too, was characterised by his unassuming and genial disposition; and there are not a few of his attached friends and former pupils who can bear testimony to his suavity of manners, and the readiness and ability with which he was ever glad to communicate his stores of knowledge.

Mr Rhind then referred to the beautiful Ordnance maps of the county of Edinburgh now before the Society, and observed that it was no small pleasure to find every inch of ground which several of us have gone over again and again, so accurately and so artistically displayed in one comprehensive view before us. To those who many years ago began their studies in the only field where real knowledge can be obtained,—in the open field of nature,—such maps would have been invaluable. What labour, and doubts, and in Britain. A small portion of this is exported, but the great bulk is used for domestic purposes and manufactures, —for animating the giant arm of the steam-engine, and for sending our steam-ships over every region of the globe. The present aspect of the county was next alluded to,—its division into three alluvial valleys, watered by three rivers which flow into the estuary of the Firth,—the Pentland range of hills, their diversified scenery,—and the remarkable basaltic rocks surrounding and forming the basis on which the city is built. There are no means of knowing what was the condition of the local atmosphere of Mid-Lothian in former times—at periods when the country was more densely covered with wood, when the ancient forests of Scotland still remained, when the surface of the soil was only partially cleared and cultivated, and imperfectly drained, and when marshes and lochs were greatly more abundant than they are at present. In the absence of actual facts, people are apt to draw on their imaginations and feelings; and it depends a good deal on the individual temperament whether we hear that the seasons are become much more severe and ungenial, or warmer and drier, than they were in bygone days. It was only towards the end of last century that scientific instruments were employed to indicate the climate of the country. From those begun by Professor Playfair in 1771, and others, continued down to the present day, it appears pretty evident that no change of climate has taken place during the last ninety years. Considerable varieties of seasons occur; the general or normal was pointed out, and the occasional or abnormal, with their distinctive peculiarities, and the great leading or general causes of difference, traced to the predominating power of the south-west and north-east air currents,—the predominance of one or the other forming the main cause of the varieties of seasons,—and to the influence of the great Gulf Stream, which flows past the British Isles. Local ameliorations of climate by drainage, cultivation of the soil, protection of plantings, &c., while they are of the greatest importance to the agriculturist and in a sanitary point of view, would appear to be too small to affect the general climatal averages. The mean annual temperature of the lower portion of the county, embracing a series of years, may be stated at [illegible] Fahr.; the rain-fall 24·6 inches. The mean annual temperature of the city of Edinburgh, for the last three years previous to 1860, is 48°·3 Fahr., by the lists of the Meteorological Society. This is equal to if not higher than the annual temperature of any of the Scottish towns, and only 2° lower than London. The annual rain-fall at Greenock, on the west coast, is two-thirds more than that of Mid-Lothian. Mr Rhind concluded by recommending to the members of the Society, of whom there were several eminent in the various departments of natural history, to combine their labours in a complete investigation of the physical history of the county. We owe much, he said, to the labours of our predecessors in this respect; and it is but just that we should endeavour to do something for those who are to succeed us.

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* Mr Rose was originally a turner of wood and ivory. He was much employed by the late Sir John Leslie in the construction of his many meteorological instruments.

A vote of thanks was unanimously given to Mr Rhind for his address, and his valuable services while President of the Society, his term of service having now drawn to a close.

The Secretary was instructed to engross in the minutes of the meeting portions of the President's address referring to the death of Mr William Oliphant; and to send an extract of the minute to his widow, Mrs Oliphant, as a mark of the Society's respect for the memory of its late member and office-bearer, and of sympathy with her in her bereavement.

reptile *Plesiosaurus*. But in others the homomorphism is so perfect, that animals belonging to the lower class were long confounded by the most eminent zoologists with those of a higher class. Thus, various species of the *Foramenifera* were classed amongst the *Cephalopoda*. The shells of many of the *Foramenifera* are, indeed, exact copies of those of *Cephalopoda*, both recent and fossil. The recent Nautilus and Argonaut, and the fossil *Baculite*, *Orthoceratite*, *Hamite*, and *Ammonite*, find their representatives in the microscopic *Numulina*, *Polystomella*, *Dentalia*, *Cristellaria*, and *Rotalina*. The shells of the former are inhabited by the highly organised cuttle-fishes; those of the latter by creatures which can scarcely be said to possess any organization. The chambers of their shells are filled with a glairy living mass, which streams like a fluid in and out through the innumerable minute pores with which the shells are pierced. The streams unite together to form widely-spread meshes and expansions, which envelope, absorb, and digest smaller living beings coming in contact with them, and on which the animals move, or rather flow along. But although the forameniferous animal is a mere fluid mass, destitute not only of organs and stomach, but even of the simplest cellular structure, it is yet capable of exercising the most important functions of life—motion, nutrition, and reproduction,—and of erecting for itself edifices mathematically correct in design, which arrest the eye by their exceeding beauty of form and ornamentation, and which, deserted by their tenants through successive ages, have formed no inconsiderable part of the solid frame-work of our globe. A curious instance of "homomorphism" occurs in the subject of the present notice, *Ophryodendron abietina*, which is fashioned after the type of *Sipunculus Bernhardi*, a highly organised Echinoderm. This animal consists of a shapeless oblong mass, immoveably fixed to the corallum of *Sertularia pumila*. From one end of the mass arises a closely wrinkled proboscis, surmounted by a tuft of short tentacles. The proboscis can be entirely withdrawn into the body, or extended to an astonishing length, until it appears as a clear glassy wand, twenty times as long as the animal, and clothed at its upper part by about forty scattered tentacles, which twine about in most violent motion. The animal seems to be constantly searching the water around for prey, and occasionally to press the tentacles firmly against the body of the proboscis, as if to imbed some matter into the soft substance of the latter—the usual mode of feeding amongst the *Acinetiens*, to which class it belongs. It is impossible not to be struck by the extreme similarity in outward form between this animal and the Echinoderm *Sipunculus Bernhardi*. In both animals occur the same shapeless body, the same entirely retractile proboscis crowned with tentacles, and the same peculiar motions in seeking for prey. But with the form, the similarity ends, for the Echinoderm possesses a highly organised structure, while in the transparent Protozoon no structure at all has been detected.

(2.) *On Hermaphrodite Reproduction in* Chrysaora hyoscella. (Plate IX).—Professor Allen Thomson, in his "Treatise on the Ovum,"* states that "the Discophoræ (Medusæ) are of distinct sexes." I have found this to be the case in all the Steganophthalmata and Gymnophthalmata which I have examined, with the exception of the subject of this notice.

Large individuals of *C. hyoscella* are hermaphrodite; but smaller ones are found which are unisexual, the male or female element being suppressed, as in some diœcious plants.

pouch. This opening is closed by the ovarian membrane, which consists of three layers—1. the endoderm, or intestinal layer; 2. the gelatinous layer; and 3. the ectoderm, or dermal layer. The ovarian membrane appears as a flocculent mass, from its being corrugated into numerous folds. By injecting air beneath it, it becomes inflated, and the folds are opened out. It then presents the appearance of a large transparent bag traversed by flat convoluted bands. These bands are the ovaries, and contain, between their endoderm and gelatinous layer, countless ova and planuloid larvæ in various states of development.

The ova of *C. hyoscella* do not present, at any stage, a trace of germinal vesicle or spot—objects which are so readily detected in the ova of other polypoid zoophytes.

The planuloid larvæ resemble those of *Medusa aurita;* but the polyps into which they become developed approach more closely to the Lucernarian type, in having a pedicle which is surrounded by a gelatinous covering, and at its foot by a horny corallum, which I have described and figured elsewhere.*

The structure and position of the male organs are remarkable. Attached to the inner surface of the ovarian membrane by delicate pedicles, and projecting into the stomach, are numerous large grape-like bodies of translucent "jelly," accompanied in many cases by fringes of tentacles of the same substance (Plate IX. fig. 1). The surfaces of the first bodies are dotted with minute papillæ, and on the tentacles are found tubercles or thickenings covered with similar papillæ. These papillæ are sperm-sacs filled with spermatic cells and spermatozoa (fig. 4). Smaller bodies, about the size of a hemp-seed, and specked with sperm-sacs, also occur attached to various parts of the lining membrane of the stomach, and even to that of the lips or long oral tentacles, *down to the very tips of those organs.*

The small Chrysaoras (about 4 inches in diameter) have no ovarian bands in their pouches, which only contain masses of the grape-like bodies and tentacles before mentioned. These tentacles are not homologous with the minute, hollow, cnidophorous or sting-cell-bearing tentacles found on the inner surface of the ovarian membrane of *Medusa aurita* and *Lucernaria auricula;* they are simply, as are the grape-like bodies, prolongations of the endoderm and gelatinous layer of the ovarian membrane.

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* Edinburgh New Phil. Journal for 1859.

Although the *testicles* of *Chrysaora* are apparently not homologous with those of other zoophytes, yet in reality they differ but little from those of *Actinia* and *Lucernaria.* I have given, in Plate IX. fig. 2, a section of the testicle of *Chrysaora,* and in fig. 3, of one of the same bodies in *Actinia mesembryanthemum.* In *Chrysaora,* the thin endoderm (*a*) forms the distant sperm-sacs which project from the surface. In *Actinia,* the thick endoderm (*a*) also forms the more closely aggregated sperm-sacs, and fills up the interstices between them. The testicle of *Lucernaria,* again, resembles in shape and structure fig. 3; but the sperm-sacs are so closely moulded together, that they form hexagonal prisms divided from each other by exceedingly delicate walls of endoderm.

The sperm-sac of *Chrysaora* (fig. 4), as well as of other Steganophthalmatous Medusæ, Lucernarias, and Actinias, is thus always formed of the endoderm or lining membrane of the digestive system, while the sperm-sac of *Hydra* (fig. 5), the Hydroid Polyps, and the Gymnopthalmatous Medusæ is formed of the ectoderm. In the first class of animals the spermatic cells (fig. 4) become first matured into spermatact with the generative elements, is transparent and structureless. The internal layer, communicating with the cavity of the digestive system, is loaded with brown granules. In *Coryne glandulosa*, the ova are at an early period observed attached to the transparent layer of the endoderm, and separated from the ectoderm by a wide space of fluid. In *Hydractinia*, the reproductive polyps of which possess a muscular coat, that coat intervenes between the ova and the ectoderm.

In the subject of this paper, the ectoderm does not enter at all into the constitution of the sperm-sac. We may therefore conclude that the ova and spermatic plasma are detached or secreted from the external surface of the endoderm, which continues to convey nutriment to the former until they are fully developed.

### EXPLANATION OF PLATE IX.

Fig. 1. Male organs of *Chrysaora hyoscella*: *a*, grape-like bodies dotted with sperm-sacs and attached to the ovarian membrane, *b*; *cc*, tentacular processes bearing tubercles and sperm-sacs.

Fig. 2. Section of tubercle bearing sperm-sacs, from the extremity of long oral tentacles: *a*, endoderm; *b*, "jelly;" *c*, ectoderm.

Fig. 3. Section of similar tubercle from *Actinia mesembryanthemum*, showing sperm-sacs formed by and imbedded in endoderm, *a*; *b*, interstitial tissue.

Fig. 4. Single sperm-sac of *C. hyoscella*: *a*, endoderm; *b*, unripe spermatic cells; *c*, spermatozoa; *d*, "jelly."

Fig. 5. Sperm-sac of *Hydra viridis*: *a*, endoderm; *d*, ectoderm; *b*, unripe spermatic cells; *c*, spermatozoa bearing the same relations to the constituents of the sperm-sac as in fig. 4.

## III. *On the Serial Homologies of the Articular Surfaces of the Mammalian Axis, Atlas, and Occipital Bone.* By John Cleland, M.D., Demonstrator of Anatomy in the University of Edinburgh.

In works on human anatomy it has been customary to compare the articular surfaces of the atlas, and the superior articular surfaces of the axis, with those of the oblique processes of other vertebræ, as if they were homologous, notwithstanding the apparently anomalous manner in which, according to that view, the first and second spinal nerves must be considered as emerging from the spinal canal. The circumstances, which have led to this comparison being made, are merely the rapid diminution in size of the intervertebral discs from the thoracic region up to the axis, and a general similarity of appearance between the articular surfaces of the atlas and axis and those of succeeding vertebræ; and though the impropriety of this comparison has been exposed in very explicit terms by Professor Henle,* there is still room for a few remarks as to the precise parts of other vertebræ to which the surfaces in question correspond.

In order to arrive at a just conclusion upon this subject, we shall find it advantageous to examine the atlas in the bird. In it we find on the posterior aspect a pair of true oblique processes passing backwards, to articulate above the intervertebral foramina with a corresponding pair of processes of the axis, similar to those of succeeding vertebræ; while inferiorly there is a cartilaginous surface which forms, with the body of the axis and its odontoid process, a joint similar to those between the succeeding bodies of vertebræ. On the anterior aspect of the atlas there are no articular processes like the posterior pair; and there is presented for articulation with the condyle of the occipital bone, a single surface, exactly corresponding in extent with that which articulates with the body of the axis. As regards the occipital condyle, its constitution will be best understood by looking at the quite similar condyle of the occipital of the turtle. In it the middle and lower portions are formed by a cup perforated by a small foramen, through which a ligament passes from the tip of the odontoid process to the occipital condyle, and the part of the cup which lies above the foramen is formed by a transverse ligament. This transverse ligament corresponds to those which pass from side to side of the bodies of other vertebræ, and are attached to the superior angles of their anterior aspects—those angles which are derived from the arches.* Now, in mammalia, not only is the function of the transverse ligament of the atlas the same as in birds ; but in many of them the heads of the ribs of opposite sides are united above the intervertebral discs by transverse ligaments (*ligamenta conjugalia costarum*), which very obviously correspond to the ligaments just mentioned on the vertebræ of the bird ; for, though they do not, like them, pass from angle to angle of the bodies of the vertebræ, they are attached to structures interpolated between these angles. It appears, therefore, that the transverse ligaments of the atlas and other vertebræ in birds, and the ligamentum conjugale costarum, and transverse ligament of the atlas in mammals, are all homologous structures ; and, in that case, the only difference between the atlo-occipital articulation in the mammal and in the bird is, that while in the latter it is single, in the former it is divided into two lateral parts. But this is not an important distinction ; for in the atlo-axoid articulation, we find the arrangement in many mammals, as in the human subject, similar to that of the atlo-occipital ; while in others, as in the sheep, a single joint extends across the middle line exactly as in the bird.

The serial correspondences of the vertebral articulations are very well illustrated in the human fœtus. The articular surfaces of the oblique processes are situated immediately behind the transverse processes, and in the cervical region the arches are bulged outwards at the points where they are placed (fig. 5). The axis is shaped altogether like one of garded as the centrum of the atlas,—a view which seems to be supported by its very large comparative size in the young condition, long before the anterior tubercle of the atlas makes its appearance,—then we must recognise in the odontoid ligaments the terminal member of the series to which the transverse ligament of the atlas and the ligamenta conjugalia belong; and indeed the arrangement of their fibres, some of which are continuous from side to side, is favourable to this supposition, and reminds one of the ligamentum conjugale in the sheep.

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* I have described and figured the ligament here referred to in a paper "On the Structure, Actions, and Morphological Relations of the Ligamentum Conjugale Costarum," in the Edinburgh New Philosophical Journal, April 1859.

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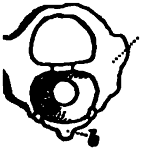

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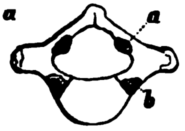

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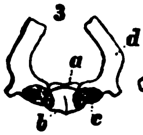

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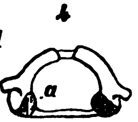

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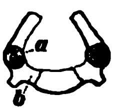

Fig. 1. Atlas of a young *Chelonia virgata*—after Rathke. *a*, The arch *b*, Osseous centre of the tubercle.

Fig. 2. Dorsal vertebra of a young seal, for comparison with the following figures: *a*, Oblique process. *b*, Articular surface for head of rib.

Fig. 3. Superior aspect of the axis of a human fœtus. *a*, The centrum, *b*, Odontoid process. *c*, Superior articular surface. *d*, Bulging of the arch in the situation of the inferior articular surface.

Fig. 4. Inferior aspect of the atlas of the same subject. *a*, Articular surface.

Fig. 5. Cervical vertebra from the same subject. *a*, Oblique process. *b*. Part of the arch entering into the composition of the body of the vertebra.

Note.—Since writing the above, my attention has been called to Rathke's work, "Ueber die Entwickelung der Schildkröten," in which (page 77) the view that the odontoid process is the centrum of the atlas is strenuously urged, and strong evidence brought forward in its favour. See also Owen, "On the Homologies of the Vertebrate Skeleton," page 93. Rathke points out that the ligamentum suspensorium, which, in the birds and higher reptilia unites the odontoid process to the occipital condyle, is the serial representative of the intervertebral discs behind. He found that in most chelonians it consisted of true cartilage, and that in certain birds it was composed of fibro-cartilage. This view of the ligamentum suspensorium is quite consistent with the suggestion which I have offered, that the during the autumn of the previous year; but unfortunately nothing but the head and wings were preserved. The bird was new to the keeper, being the first of the kind he had seen.

(2.) Picus major. (Linn.) *The Pied Woodpecker.*—The Pied or Greater Spotted Woodpecker exhibited, was taken on Mr Trotter's property of The Bush, near Penicuik, on 7th November. Mr James Stewart, who shot the bird, was attracted, at about 100 yards distance, by the noise made from its tapping on the trunk of a large oak tree. The bird was an adult male, showing the crimson occiput. It is one of our permanent residents, but rare.

Dr Smith brought under the notice of the Society in 1851, a specimen killed in the neighbourhood of Dryburgh Abbey.

(3.) Lanius excubitor. (Linn.) *The Great Grey Shrike.*—Dr Smith noticed the capture of a Great Grey Shrike, on the 9th of November, in the vicinity of Dirleton, East Lothian.

(4.) Perdrix cinerea. (Linn.) *Common Partridge.*—An accidental variety of the Common Partridge was also exhibited, showing pure white feathers in the scapulars, wings, and tail.

### V. *A large Cup-shaped Sponge was exhibited by* JOHN ALEXANDER SMITH, M.D.

A very large and fine specimen of a Cup-shaped Sponge, *Halichondria ventilabrum*, attached by its base to a stone, was exhibited. It was sent from Shetland, where it had been dredged up from the sea bottom. The Sponge was sent for exhibition, at Dr Smith's request, by Mr James Carfrae, Princes Street, who was desired to make inquiries as to the exact locality where it had been discovered.*

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* This sponge has since been acquired for the Museum of Natural History, University.

*Wednesday, 26th December*, 1861.—William Rhind, Esq., President, in the Chair.

The following gentlemen were elected the Office-bearers for the Session 1860–61:—

*Presidents*—Thomas Strethill Wright, M.D., Alexander Bryson, Esq., James M'Bain, M.D., R.N.

*Council*—John Coldstream, M.D., Andrew Murray, Esq., John Cleland, M.D., William Rhind, Esq., David Page, Esq., William Turner, M.B., Esq.

*Secretary*—John Alexander Smith, M.D.

*Assistant-Secretary*—James Boyd Davies, Esq.

*Treasurer*—George Logan, Esq.

*Honorary Librarian*—Robert F. Logan, Esq.

*Library Committee*—W. H. Lowe, M.D., John Anderson, Esq., John Livingston, Esq.

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*Wednesday, 23d January*, 1861.—Alex. Bryson, Esq., President, in the Chair.

William Burns Thomson, Esq., surgeon, Superintendent of Medical Mission Dispensary, 39 Cowgate, was elected a non-resident member of the Society.

The following donations to the library were laid on the table, and thanks were voted to the donors:—

1. Biographical Sketch of the late William Oliphant, Esq., publisher, Edinburgh.—From William Gibb, Esq. 2. Iagttagelser over Den Postpliocene Eller Glaciale Formation I En del Af Det Sydlige Norge. Af Profr. Dr M. Sars og Lector Th. Kjerulf. Christiania, 1860.—From the

their American brethren Physick and Levert, on the probable benefit likely to result in the treatment of wounds, from substituting metallic threads for those of silk or hemp usually employed. They were led to this opinion by observing the small amount of irritation sometimes resulting from the presence of a metallic substance, such as a bullet, in the textures of the body. I was then engaged with Professor Simpson in experimenting upon animals, and endeavouring with him to collect reasons why the metallic thread should supersede the silk one.

As an instance of how little irritation is caused by metal left in living tissues, I instanced the practice of marking par, grilse, &c., with wire, and these marks being found in the fish after months or years; whereas, had the material of the marks been non-metallic, they would most probably have cut or ulcerated out of the tissues. I was told that this was no argument, as fish did not inflame—at all events, that their tissues did not ulcerate or suppurate—and I was referred to the following passage in Macartney's treatise upon inflammation: "In neither of the two classes of vertebrate animals with cold blood do I believe it possible to produce the genuine effects of inflammation. In conducting some experiments on the swimming-bag of fishes, I was surprised to find that the wound made into the belly did not inflame. I was therefore curious to know what injuries fishes would bear without producing inflammation. Having taken some living fishes from the water, I introduced pieces of wire beneath the skin and amongst the muscles of the body; the fishes were then returned to the water, and on examining them several days afterwards, I found that no suppuration had taken place. The tracks of the wounds were pale and smooth, and only moistened with a serous fluid, and none of the usual appearances of inflammation were visible. A very common occurrence in fishes is the existence of worms, which perforate the tunics of the alimentary canal, without producing any change of structure, except an increased vascularity around the perforations. The reproductive power of fishes is confined to the fins, which are sometimes regenerated after being lost by accident, or by a species of death which is quite different from that which is the consequence of inflammation in the higher classes of animals."

Dr Macartney's book was published so far back as 1838, and many will be inclined to say, "Nous avous changè tout cela;" but I am not aware of any allusion to the subject in more recent works, and several authorities upon physiology, of whom I made inquiries, gave me answers to the same effect as Dr Macartney.

But when I inquired of the fishmongers, who took a more practical view of the matter, I met with very different answers,—not only that pus was found in fish, but pretty frequently met with in particular kinds, in the turbot and the cod especially; that they habitually looked for abscesses in the former fish, so that they might evacuate their contents before sending them away to customers.

As it was now pretty clear that somebody was wrong, I endeavoured to test the different statements by the following experiments:—

1. I passed four threads of Paisley twine through the back of a tench which weighed about 1½ lb.

2. And the same number obliquely through the side of a somewhat smaller tench. The threads were tied loosely in, and the fish were placed in a large metal bath.

These setons seemed to give the fish no uneasiness for four days, but after that time they exhibited symptoms of discomfort; instead of swimming round the bath side by collect, from time to time, sufficient of a yellow fluid which presented all the microscopic characters of pus, but was generally mixed more or less with muscular fibre, however gently I pressed it along the seton track. I had made the wound in the largest fish too transverse, and the water flowed through it, so that I obtained no satisfactory results until I made the water so shallow that this portion of his back was left bare, or floated him up with corks; I could then obtain some good yellow pus.

Not only did the irritation of the setons induce the formation of matter, but they produced a destructive ulceration in the smaller fish; the substance was lost subcutaneously, until merely a layer of skin covered the threads, and the orifices of the wound grew daily wider. In the larger fish the tissue over the seton became of a purplish colour, and at the end of three weeks the latter had nearly cut its way out. After removing them the wounds speedily healed.

Being now anxious to see how wounds were repaired in these animals, I cut a piece off the larger fish's back, taking care not to injure important parts, as the spine. This appeared very cruel, but so far as ordinary evidences of sensation go, it seemed to him a matter of total indifference; he would make no movement if you scratched or pressed the surface of the wound; and so far from its affecting his appetite, he ate in one night twelve sticklebacks, six minnows, and four tadpoles, in addition to vegetables.

For a fortnight this wound remained unaltered in appearance, except that it appeared sodden by the water; then three large straight blood-vessels were seen distinctly crossing it in an antero-posterior direction; and in twenty-four hours they were again obscured by a thick film, which grew thicker and denser, and then separated, floating off upon the water, and leaving a bright pink surface exposed; this changed to a darker hue, and granulations sprang up. I never saw any pus on the surface even when it was kept out of the water, the granulations did not bleed readily, but the raw surface now seemed very sensitive to pain; the unfortunate fish seemed to dread the slightest touch; letting fall a drop of water over his part of the bath set him splashing and struggling round it. The colour of the sore gradually darkened, the granulations grew irregularly, and some seemed to get œdematous and languid, as we see in languid sores in mankind; the edges assumed the bluish white tint we also observe on the margins of a healing ulcer. The wound seemed to be gradually contracting, but very slowly, and the fish was evidently in constant suffering. Some gold fish which I put into the bath along with him kept him constantly nervous lest they should hurt his back, and he would spring occasionally out on the floor; he did so one day, when no one was near to assist him, and beat his head against the leg of a sofa till he died.

I next selected two large gold fish, and transfixing their sides from above downwards, with a sharp bistoury cut flaps with the free edge towards the tail, so that the water should keep the flaps in apposition. The fish went on feeding quite unaffected by the operation. In forty-eight hours I examined them, and found the flaps adherent at their thickest parts, but I could still lift up their edges. On the next day the edges were fixed down by a material which I did not observe while they were in the water, on account of its transparency. It was limpid and firm in consistence, painted freely over the line of incision, and for about an inch beyond it in each direction. In one fish I passed a probe through this material under the flap; this evidently gave the fish great pain, and a drop of blood escaped.

Vessels formed and were distinctly seen with the naked fish are followed by effects, at all events very *similar* to those we see in land animals,—viz., that there are the same efforts of nature to throw off from the body substances foreign to it of an irritating nature, by what we term ulceration and suppuration; that the formation of the pus appears to be accompanied with disintegration of the tissues in which it lies; that simple cuts heal by primary adhesion; and the entrance of water is prevented between the cut surfaces by the exudation of some material resembling lymph; that raw surfaces throw out granulations; and, if we may judge from this specimen, cicatrise.*

My friend, Dr James Sidey, has sent me many specimens which corroborate this,—viz., two fish with abscesses in their livers, surrounding spiculæ of bone. Portions of skin showing firm, depressed cicatrices, and several specimens of what appears to have been fracture of bone, reunited by osseous material. I have especially to thank Mr Reid of Frederick Street for many preparations which he has sent me.

## II. *Exhibition of Sponges, with Explanatory Remarks.* By JAMES M'BAIN, M.D., R.N.

At the first meeting of the Royal Physical Society, held this session, Dr J. A. Smith exhibited a remarkably fine specimen of a British sponge, the *Halichondria ventilabrum*, sent by Mr Carfrae of Princes Street. It was not known exactly at the time from what part of Shetland the specimen had been obtained, but Mr Carfrae had since then received information from its owner that it was caught up by a fisherman's net off Sumburgh Head, the southern point of Zetland. The specimen measured 21½ inches in diameter, and 10 inches in height.

The specimens of *Halichondria ventilabrum*, which I now exhibit, were also found in the Zetland seas, and are intended to show the great range of variation in size and form to which this species is liable.

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* The specimen referred to was the tail of a ling, which exhibited three inches of a depressed cicatrix. Since the above was written I have received many more specimens and varieties of tumours.

The description of *H. ventilabrum* given by Dr Fleming in his "History of British Animals" is so accurate and complete, that it is quoted by Dr Johnston, when treating of the same species, in his "History of British Sponges."

Dr Fleming describes it "as extremely variable in form, forming an entire cup, becoming shallower with age, of upwards of a foot in diameter; or with a cup divided into irregular lobes at the margin, or split, and exhibiting a fan-shaped leaf; the base, by which it adheres to stones, is solid, and the stem is very short; the substance is thick at the base, becoming thinner towards the margin; when old, the central part thickens, becomes reticular, with a brittle exterior covering, which may be rubbed off, leaving a skeleton not unlike some *Gorgoniæ;* the pores are of various sizes, those on the inside of the cup or leaf are larger and less angular than the external ones; the spicula are numerous and much matted; the gelatinous matter abounds in the young portions, especially towards the margins, and produces a cracked surface when drying."

The other species, belonging to the natural family of *Spongiadæ*, also vary extremely in size and shape, according to the difference of locality and conditions of temperature where they are found. I have here specimens of *Halichondria infundibuliformis*, from Zetland, that differ greatly in size and form. These examples prove how unsatisfactory any classification would be that was based upon external

Bowerbank writes, "I am very busy just now on Dr Fleming's 'Cydonium,' and there are a few points regarding the original specimen that I shall be very glad to get information about. I have just finished a monograph of 'Spongilla.' I have, besides our two British species, six from India, and six from the river Amazon. I think this addition to the fresh-water sponges will rather surprise our friend Dr Fleming." In December 1855, Dr Bowerbank says, "Dr Fleming's arrangement of the Sponge genera is—

1. TETHEA.
2. HALICHONDRIA.
3. SPONGIA.
4. GRANTIA.

"Dr Johnston in his 'Synopsis' has—

1. TETHEA.
2. GEODIA.
3. PACHYMATISMA.
4. HALICHONDRIA.
5. SPONGILLA.
6. SPONGIA.
7. HALISARCA.
8. GRANTIA.

From both these forms of arrangement I feel strongly disposed to dissent; and with regard to the latter form, I think *Geodia* and *Pachymatisma*, as being more highly organised, should have precedence of '*Tethea*;' and '*Grantia*' should take precedence of the whole. I therefore propose the following as the primary divisions of the tribe:—

1. Calcareous sponges.
2. Silicious sponges.
3. Keratose sponges.

"The order of the existing genera would then be as follows:

1. GRANTIA.
2. GEODIA.
3. PACHYMATISMA.
4. SPONGILLA.
5. TETHEA.
6. HALICHONDRIA.
7. SPONGIA.

*Halisarca* merging into the *Halicondraceæ*. *Spongilla*, from its highly organised reproductive system, and from the similarity of those organs in many respects to those of *Geodia* and *Pachymatisma*, requires that its position should be between the latter genus and *Tethea*. *Halichondria* will cut up into, at least, ten new genera. I am now very busy at a paper for the Royal Society, 'On the Organisation of the *Spongiadæ*,' which must be published before my new terminology can be understood. I intend to describe and figure every normal form of every organ, with a definite name and description of each. I am really very much indebted to Dr Fleming for his kind assistance, and sincerely wish I could in conscience support his *Cydonium* to the exclusion of *Geodia*. Present my respects to him." In February 1856, Dr Bowerbank says, "I have just received such a glorious box of sponges from Western Australia, radiant with colour, purple, rose, cream, and all sorts of tints, and full of fleshy matter. There are forty-four grand specimens, some eighteen inches high, but when shall I get to work on them! I am overwhelmed with material, having received advice of another large collection of sponges and corals from Madeira, which are on their way. I think I must take Finsbury Square by-and-by, or I shall have no chance of exhibiting them. I am glad you and I agree so well regarding the arrangement of the *Spongiadæ*. It is quite delightful to have some one like yourself to write to about them, all the rest of the world seem to dread them as much as they do human sponges. I am working nightly for four or five hours at them, but seem to make slow progress ; but the labour is most delightful to me, and every day brings some new fact before my eyes. I have now named and ready for drawing above a hundred different forms of spicula, and I am working hard to get them ready for a paper for the Royal Society, if possible, this season. In the spring I shall go to Tenby, and have two or three weeks' work at the living specimens, and work out all my suspicions and beliefs regarding them."

Association held in 1857, it was proved that the organs of incurrent action were situated within the large intermarginal cavities, as in *Grantia ciliata,* and not immediately around or within the pores. The vigorous imbibition and ejection of the surrounding water was as strikingly indicative in the fresh-water sponge, as it was in the marine one, of the period of feeding; while the languid action in either case distinctly marked the ærating process only, during which the digestion of the nutritive particles previously imbibed is gradually effected, and the effete matter partially ejected. "The structure of the pores, and the perfectly plastic nature of the dermal membrane, as exhibited in these observations," Dr Bowerbank says, "are very remarkable. The sensitiveness of the sponge to injury, the rapidity of the act of closing those organs, and the power they appear to possess of opening new ones to any extent, and in any direction they please, attest an astonishing amount of vital energy in a membrane in which he had been unable to trace any indication of the existence of fibrous tissue."

On the 18th of June 1857, a paper was read before the Royal Society of London, "On the Anatomy and Physiology of the *Spongiadæ.*" By J. S. Bowerbank, LL.D., F.R.S., &c. In that highly valuable and original monograph, Dr. Bowerbank points out the faulty system of Lamarck, founded upon external form, "inasmuch," he says, "as there is no class of animals in which the form varies to so great an extent, according to the difference of locality, or other circumstances." He remarks "that the division of the *Spongiadæ* by their chemical constituents, adopted by Fleming, Grant, Johnston, and other modern naturalists, may serve very well to separate them into primary groups, but that these are far too limited to be applied as generic characters." He therefore rejects both systems, retaining the latter for forming primary divisions only, and proposes founding the generic characters principally on the organic structure and mode of arrangement of the skeleton. Dr Bowerbank accepts all the well-established genera of his predecessors, such as *Tethea, Geodia, Dysidea,* but confines each genus strictly within the bounds indicated by the peculiar mode of the structure of the skeleton which exists in that species of sponge which is the oldest established and best known type of the genus, and refers all others that may distinctly differ from that type to new genera founded on structural principles. When Dr Bowerbank commenced, in like manner, a critical examination of the specific characters of preceding authors, and endeavoured to collect and classify them, he found them to be still more indeterminate than those of class or genera; it appeared to him that there was scarcely an approach to a distinct terminology of the science, and that the same author frequently designated the same organ, under different circumstances, by a totally different name. He therefore felt it absolutely necessary, before proceeding to the description of new species, to enter into a thorough systematic examination of the organisation of the whole of the species within his reach, and to characterise the organs in such a manner as to render the terms he applied to them definite in their meaning, and limited in their application; and in pursuing that object he quickly found abundance of constant and well characterised forms and combinations of organisation capable of being applied with precision to the purposes of generic and specific descriptions."

He therefore proposes to characterise the elementary tissues in the following order:—

1. Spicula,
2. Keratode, or horny substance,
3. Membranous tissues,
4. Fibrous tissues,
5. Cellular tissues,
6. Sarcode;

method of investigation of the *Spongiadæ*, undertaken by Dr Bowerbank; and from his well-known microscopic ability, persevering industry, and accuracy as an observer, no one is better qualified for the task, nor more likely to do full justice to it.

In the paper referred to, the early stage and development of spicula is described. "They appear to consist of a double membrane, between which the first layer of silex is secreted, and in this condition they present an internal cavity approaching very nearly to the size of their external diameter. In this state they readily bend abruptly in any direction without breaking. An interesting fact, in regard to the animal nature of the sponge, is, that many forms of the spicula have their types in the more highly organised class of animals, and especially among the *Zoophyta*, the *Tunicata*, and the *Nudibranchiate mollusca*. The spicula are always of an organic type, and never crystalline or angular. Each species of sponge has not one form of spiculum only, equally dispersed throughout its whole substance, but, on the contrary, separate parts have each its appropriate form, and three, four, or even more forms often occur in the same individual; and in *Tethea cranium* there are no less than seven distinct shapes. The spicula appropriate to particular parts of the sponge are uniform in their general characters throughout the whole of the *Spongiadœ*, and a great portion of them are so well characterised by their form as to enable the student, when once well acquainted with their peculiarities, to assign each readily to its proper place in the sponge."

These organs are treated of in the following order:—

1. Spicula of the skeleton.
2. Connecting spicula.
3. Defensive spicula.
4. Spicula of the membranes.
5. Spicula of the sarcode.
6. Spicula of the gemmules.

The monograph is accompanied with four beautiful plates, containing upwards of two hundred figures of the different forms of spicula, with a distinct appellation for each form. The scientific world is therefore indebted to Dr Bowerbank for a new arrangement of the *Spongiadœ*, with a precise terminology and nomenclature, founded on the anatomical structure and physiology of the species.

I have taken this opportunity to give a brief notice of these recent investigations and discoveries, as they are unquestionably the most valuable additions to our knowledge of the *Spongiadæ*, since the original contributions of Dr Robert Grant, published in the "Edinburgh Philosophical Journal" for 1826.

### III. *Report of the Committee on Marine Zoology; with a Notice of the Sprat-Fishing in the Firth of Forth.* By George Logan, Esq., Convener. (With exhibition of specimens).

Mr George Logan, W.S., the Convener, read the report of the proceedings of the Committee on Marine Zoology for the past year. The Committee, among numerous other captures, obtained a fine specimen of *Corystes cassivelaunus*, the masked crab, dredged up in Aberlady Bay. Living specimens of *Kellia suborbicularis*, found plentifully in dead valves of *Tapes virginea*, near Inchkeith, in September last, lived for rather more than six weeks. Although great numbers of the hermit crab, *Pagurus*, were examined, dredged in about six fathoms water, in expectation of finding the parasite *Peltogaster paguri* frequently attached to it, not a single specimen was discovered. *Sacculina carcini* was found at Trinity attached to the abdomen of the common edible crab, sometimes two or three on one animal. To show how very little particular the hermit or soldier crabs are in the choice of their residence, one was dredged

Royal Society of Edinburgh, and in the "Magazine of Zoology and Botany," under the name of *Monochirus minutus.* He does not include it in his "Fishes of the Firth of Forth," and the Committee are not aware of its having before been obtained there; but from the occurrence of so many specimens in one day, it would seem to be not very rare. Some of the specimens were brought home alive, and one of them lived for nearly three months, until killed by the recent severe cold. It was very sluggish, remaining always at the bottom of the aquarium, and seldom moving unless disturbed. When fishing with the seine net along the shore eastward of Leith, a number of species were taken, which will give some idea of the fishes which occur on this limited portion of the coast. The most abundant fish, of course, by far, is the mud flounder, *Platessa flesus*, along with which were always a considerable number of plaice, *Platessa vulgaris*, and a few salt water flounders, *P. limanda*, the proportion of the latter being very small to the other two. One or two specimens of the common sole occurred during the season, and a single specimen of the brill, *Rhombus vulgaris.* Numbers of small thornbacks, *Raia clavata*, occurred along with these on the sandy portions of the shore, mingled with shoals of young *Triglæ.* The sting fish, *Trachinus vipera*, the armed bullhead, *Aspidophorus cataphractus*, and the one-spotted goby, *Gobius unipunctatus*, were in abundance in spots where much ulva and enteromorpha grew. Two or three specimens of the common pipe fish, *Syngnathus acus*, occurred along with these, and a considerable number of the green cod, *Merlangus virens.* A few specimens of the viviparous blenny and five-bearded rockling also occurred, and a single specimen of the sordid dragonet, *Callionymus dracunculus*, and one of the short spined cottus, *Cottus scorpius.* The spotted gunnel fish, *Muraenoides guttata*, was not scarce in pools among the Black Rocks, and proves a most admirable fish for the aquarium, living long, and becoming quite tame when fed with small earth worms. Two small salmon trout (*Salmo trutta*) were caught during the season, each about two pounds in weight, one close to the Black Rocks, and the other near Portobello.

The Committee made reference to the herring and sprat or garvie fishery of the Firth of Forth, which has recently excited so much interest, and upon which so much contradictory has been said and written. Certain members of the Committee devoted much time and attention to the subject, examining separately the product of the fishery in the boats and in the fish-carts since the 4th of the current month of January, when the Fishery Commissioners withdrew the prohibition against sprat-fishing; and the result of close investigation of large masses of fry at various times has been, that the proportion of herring, *Clupea harengus*, less than 6 inches long, taken among the sprats, *Clupea sprattus*, is very small; one of the examiners found on an average only one herring fry among a hundred sprats over a very extensive field of investigation; others found the proportion of herrings rather larger; but they all concurred in thinking that the comparatively small quantity of herring fry caught with the sprats could not in any sensible degree affect the former; and when it is considered that the roe of a single herring contains such an enormous quantity of ova (32,000), and that the fish spawns upon our shores in countless millions annually, the sensitiveness which has been shown as to the taking of even a few tens of thousands of young herrings among the sprats seems to be without foundation. A limited close-time, or protection in a limited area, would probably do infinitely more towards the protection of the fishery than any needless and unpopular prohibition of sprat or other fishing. Specimens of the smallest size of herring and the largest size of sprat ordinarily occurring amongst the masses caught were exhibited; and, although the distinguishing marks were very apparent, even to the ordinary spectator accustomed to the appearance of the fish, there seemed to the Committee to be no mode of accounting for the outcry, so far as honest, which has been made about the destruction of herring fry, but upon the supposition that the two descriptions of *Clupea*, the herring and the sprat, have not been accurately recognised, and that well-grown herrings have been denominated fry. The abiding scientific distinctions are so well known that they need not be repeated. Dr Parnell has very concisely and most accurately stated them, as noticed in the last Report of the Committee; but it may be useful to mention the prominent and easily noticed markings which separate the two species, so that any one upon looking over the surface of a mass of fish so abundantly brought to market, may distinguish without difficulty the one from the other. The head of the herring, from the point of the lower jaw to the farthest part of the gill plates, is about a fourth part longer than the head of the sprat; the eye is one-third larger; the lower jaw projects more beyond the upper jaw; the tail of the herring is dark; that of the sprat light-coloured, much broader, shorter, and less forked than that of the herring; and the body of the fish at the insertion of the tail is also much broader; the abdominal line is strongly serrated and sharp all along; the same line in the herring is rounder and quite soft (excepting in small specimens, but there is never any serration under the pectoral fins); the sprat is more plump and compact, and resembles in shape a miniature salmon, and the scales are larger, and their insertion much farther apart than in the herring. Upon the vexed subject of herring spawn it may be stated, that during several years while the herring have been upon the coast in abundance, the Committee, from the beginning of August to the middle of October, have dredged and trawled in Aberlady Bay and off North Berwick down to Tyningham Sands, without bringing up a trace of herring spawn; and they are quite satisfied that none is deposited upon proper trawling or dredging ground. Among the millions of fry which have come under the observation of the Committee during the present month not a single specimen of whitebait, *Clupea alba*, has been detected, and, what is somewhat remarkable, although whitebait was found in abundance at Seafield in the autumn of 1859, as the Committee then reported, without any admixture of sprats; during last season, at the same period, only sprats were found without any whitebait.

A vote of thanks to the Committee on Marine Zoology, and to Mr George Logan, Convener, was moved by the President, and was unanimously agreed to.

### IV. *Two Otters,* Lutra vulgaris, *shot near Edinburgh, were exhibited, &c.* By JOHN ALEXANDER SMITH, M.D.

Two full-grown otters, male and female, were sent for exhibition, at Dr Smith's request, by Mr James Carfrae, Princes Street. They were killed at one shot by a boy, near Coltbridge, on the Water of Leith, in the beginning of December, the severe weather having forced them to descend so far down the stream, to the immediate vicinity of Edinburgh.

A pure white specimen of the Alpine hare, *Lepus variabilis*, recently shot in Lanarkshire, was also exhibited.

The late severe weather had been very fatal to the common squirrels, *Sciurus vulgaris*, bringing them within the reach of the shooter; and at present the shops of the bird-stuffers were filled with them in very unusual numbers.

### V. *Ornithological Notes.* (*Specimens exhibited.*) By JOHN ALEXANDER SMITH, M.D.

(1.) Strix Tengmalmi. (Tem.); Noctua Tengmalmi. (Selby.) *Tengmalm's Night-Owl.*—The specimen exhibited, apparently a female, from its size, which is larger than the male, now measures nearly a foot in length from point of yellowish beak to tail; length of wing from flexure is seven inches. It has a soft, downy appearance, and is of a chocofeathering of its legs and feet—the *S. passerina* having merely a few bristle-like feathers on the toes; hence some naturalists give it the synonyme of *Strix nudipes.*

Only one or two instances of the capture of *Tengmalm's Owl* in England are recorded. I have seen none mentioned as taken in Scotland.

This bird was captured by a man named Lumley, on Cramond Island, during the severe snow storm, with easterly wind, about the end of the year. On entering the stable, Lumley was startled by the bird flying about, and attempting to escape at the opened door: he struck it down with his hand, and captured it. It was then taken to Mr George Hutchison, gardener to Craigie Halket Inglis, of Cramond House, Esq.; and was sent by Mr George Sanderson, George Street, for exhibition to the Society, and for the determination of its species.

(2.) Lanius excubitor. *The Great Grey Shrike.*—A specimen of the Great Grey Shrike was exhibited. It was shot in Peeblesshire about the 10th or 11th of January, and was intended to be added to the museum in the Chambers Institution, Peebles.

(3.) Turdus musicus. *The Song Thrush.*—A pure white variety of the Song Thrush; was shot in a turnip field at Roslinlee, near Roslin, in the month of October, by Mr John Dickson, gunmaker, Princes Street, who has sent it, at Dr Smith's desire, to be exhibited.

(4.) Alcedo ispida. *The King Fisher.*—Mr David Carfrae sends for exhibition two specimens of our beautiful *King Fisher.* The one was shot about a fortnight ago on the Water of Leith, near Slateford; the other in the same locality, about a month since. They are ordinary residents, but are now very rare in this neighbourhood.

(5.) *Hybrid Grouse, between Blackcock and Red Grouse.*—The bird now exhibited is probably the offspring of a male Blackcock, *Tetrao tetrix*, Pen., and a female Red Grouse, *Lagopus scoticus.* It bears considerable resemblance to each parent, and is intermediate in size, the length of the stuffed bird being rather more than nineteen inches.

The general colour of plumage above, is dark brown, mottled with reddish-brown, almost black on sides of head, and part of back; feathers of head and neck mottled, and many of them edged with white; upper part of back mottled over with yellowish-red or light brown, with here and there a feather nearly black; scapulars, greater and lesser wing coverts, are many of them tipped with white; primaries brown, third, fourth, fifth, and sixth, mottled on the outer web with white; secondaries mottled with reddish-brown, and tipped with white.

Tail black, of eighteen feathers, like black grouse; the red grouse having sixteen feathers. The four outer feathers elongated and slightly curved outwards; fourth feather very slightly longer than the others; two central feathers of tail mottled over with reddish-brown, and edged with white across the point of feather; upper tail coverts dark brown, mottled with reddish-brown, and slightly tipped with white.

Below, breast nearly black; feathers of abdomen slightly mottled with reddish-brown, and many of them broadly tipped with white; vent white; under tail coverts brown, broadly tipped with white; under surface of wings, and axillaries white.

Legs closely covered all round with white and grey feathers, like red grouse, which also cover the toes for half their length (excluding the claws); toes covered above with transverse scutellæ, on each side of which are a row of square-shaped scales, and beyond this a fringe or margin o exhibited. The bird does not assume the white plumage until the second autumn. It was shot by Captain Firman, R.N., at Taynash, Argyleshire, in the beginning of this month. Its plumage very much resembles the adult female; it is, however, rather larger in size, measuring, when stuffed, sixteen inches in length (the female being about fourteen inches long). The smaller wing coverts, instead of being pure white, are edged with dusky brown, and it shows no patch of black at the base of the upper mandible, and round eye, in the reddish-brown of head, as in the adult female and male; resembling in this respect the young female. The trachea of the bird which was exhibited shows the characteristic dilated box at its bifurcation; this is awanting in the female.

The smew is a bird of eastern Europe, and is only an occasional visitor or straggler to Scotland, being more frequently seen in the south of England. One or two specimens taken in Scotland have been previously exhibited to the Society.

The very cold weather of the winter, he might remark, had been very severe on many of our small birds, as well as on our regular winter visitors, great numbers of which had been destroyed.

### VI. Petromyzon marinus. *The Sea Lamprey.* *Exhibited by* John Alexander Smith, M.D.

VII. *Specimens of various Marine Animals, sent by* Dr E. W. DUBUC, R.N., *from Ceylon, &c., were exhibited by* Mr JAMES B. DAVIES.

A small *Physalia* (Portuguese man-of-war) from the shore at Kurrachee, Scinde. Specimens of a species of *Pinna*, both dry, and dissected in spirit, from Trincomalee, Ceylon; two species of *Pinnotheres* (a small crab), one of which inhabits the interior of the shell of *Pinna*, and the other the *Placuna placenta*, also from Ceylon.

Specimens of the Trepang, or edible *Holothuria*, in spirit, and dried, as for the Chinese market. Regarding these, Dr Dubuc supplies the following notes:—" Whilst at Trincomalee, in the summer of last year, in medical charge of the hospital hulk Sapphire, my attention was drawn to a species of *Holothuria*, very abundant on the sandy bottom of the inner harbour, at a depth of about two or three fathoms. The animal is of a yellowish-brown colour, the skin over the dorsal aspect being tough and coriaceous. The ventral surface presents numerous ambulacra, and is of a pale colour, and close to the anal orifice there is the retractile branchial tuft. At Naples the *Holothuria tabulosa* is employed as an article of diet, and at the Marianne Islands the *Holothuria guamensis;* whilst the Chinese prefer the *Holothuria edulis*, or Trepang, which is common in the Chinese seas, principally at the Anamba Islands, where the Malays fish for it with hooks fastened to the ends of long bamboos. They are then cut open, eviscerated, dipped in boiling water, and dried in the sun. It was with some interest I learned that they were prepared in the way mentioned above at Trincomalee, for the Chinese market. The natives dive for them, as they are not familiar with the use of the dredge."

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*Wednesday*, *27th February* 1861.—JAMES M'BAIN, M.D., R.N., President, in the Chair.

Thomas Robertson, Esq., Minto Street, was elected a member of the Society.

The following donations to the library were laid on the table, and thanks were voted to the donors:—

1. Description of the Plant which produces the Ordeal Bean of Calabar.

By Professor Balfour.—From the Author. 2. Transactions of the Botanical Society. Vol. VI., Part III. Edinburgh, 1860.—From the Society. 3. On the Tertiary Deposits associated with Trap-Rock in the East Indies. By the Rev. Stephen Hislop.—From the Author. 4. On the Arrangement of the Muscular Fibres of the Ventricular Portion of the Heart of the Mammal. By James Pettigrew, Esq.—From the Author. 5. The Quarterly Journal of the Geological Society. No. 62, May 1860. Vol. XVI., Part II.—From the Society. 6. Jahrbuch der Kaiserlich—Königlichen. Geologischen Reichsanstalt, 1860. XI. Jahrgang, No. I., Jan., Feb., Marz. Wien.—From the Imperial Geological Society of Vienna.

The Communications read were as follows:—

### I. *Observations on British* Zoophytes *and* Protozoa.

### *On* Atractylis palliata *and* coccinea (new species). By T. STRETHILL WRIGHT, M.D.

### 1. *Atractylis palliata*, n. sp. Pl. XI. fig. 6.

Polypidom creeping, closely reticulate. Polyps fusiform, shortly stalked, minute, white, with eight alternating tentacles; body of polyp clothed with a thick layer of 'colletoderm.' Free medusoids springing from meshes of polypary, with four-lipped peduncle; four lateral canals; two long marginal tentacles and two tentacular tubercles alternately placed.

This zoophyte was found on a shell inhabited by *Pagurus Bernhardus*, at Granton. When first observed, its closely-set and dense white polyps, surrounded by their gelatinous envelopes, were mistaken for a mass of minute ova. These and four other tubercles appear on the marginal canal, as shown in fig. 8—a change analogous to that undergone in *Bougainvillea Britannica.*

### 2. *Atractylis coccinea*, n. sp.

Polypidom creeping, widely reticulate. Polyp fusiform, set at an obtuse angle to its stalk, rich crimson or pink, with eight alternating tentacles, four long and four short.

This zoophyte was found at Inchgarvie in August last, growing on the roots of *Laminaria saccharina.* The polypary consists of an open network of milk-white fibres, which closely invests the branches of the root. From this network the polyp-stems are given off, each about a quarter of an inch in length, of a rich pinkish cream-colour, and bearing at its summit a single crimson polyp with a double row of transparent colourless tentacles. The body of the polyp is fusiform, sometimes nearly cylindrical, and consists of an endoderm having its cells laden with granules of the richest carmine-colour, covered by an ectoderm of transparent white—a white blond dress over a crimson satin petticoat. The polyps, like others of this class, have the habit of turning themselves inside out, when the internal surface of the deep-coloured velvety endoderm is readily observed. On such occasions masses of granular matter are frequently ejected, which are composed of small pigment-globules filled with crimson fluid. The tentacles are eight in number, four of which are long and held nearly erect, and alternate with the rest, which are shorter and more expanded. The thread-cells are inconspicuous.

This beautiful little zoophyte, when seen with a single lens, presents a perfect garden of minute animal flowers covering the roots of the sea-weed. The reproductive apparatus was not observed.

### 3. *On Rhizopod Structure.*

One of the most interesting and important questions of the day to the comparative physiologist is that of the constitution of Rhizopod structure. The Foraminiferous or Rhizopod animals are before our microscopic eye every day. We see their beautifully chambered shells imitating some of the most graceful objects of nature and art,—the living streams of nearly fluid sarcode, of which they are composed, flowing forth from the almost invisible pores of their shells, uniting with each other, and forming glairy masses, and reticulations, and expansions, which absorb animal matter coming in contact with them,—single and compound animals building their aggregated homes in the most graceful lines and spirals,—single dwellings and populous towns slowly moving along, of which the inhabitants are but patches of transparent slime,—vast Polythalamian cities, where the huge primordial Rhizopods reign, surrounded by the multitudes of their dwarfed descendants, in widening circles and triple tiers. Such is Rhizopod life. At present no true generative elements have been recorded as discovered in the Rhizopods, though Carpenter and Schultze have noticed bodies which they have suspected to be ova. In the autumn of 1859 I was preparing a number of specimens of Hydractinia for the microscope. They were first soaked in whisky for several weeks, then immersed in dilute nitric acid to remove them from the crab's shell, and finally washed in strong spirit, and put up in Canada balsam. On examining one of these preparations under the microscope, it was found that two specimens of Truncatulina had been accidentally prepared at the same time. The development of Truncatulina commences with a single cell; this multiplies by gemmation in series until a colony of animals is formed, each larger than its predecessor, arranged in a spiral, somewhat resembling the shell of the Nautilus. In the Nautilus, the last chamber of the shell only is occupied; but in Truncatulina every chamber contains its tenant, while the whole colony [illegible] united by a band of sarcode, which passes from chamber [illegible] chamber along the inner curvature of the shell. All the cells or houses in this Rhizopod town are full of minute pores, from which the inhabitants protrude their delicate arms of slime in search of prey, or to move the assemblage from place to place. When the Truncatulina is treated as before mentioned, the shell is removed, and the separated zooids [illegible] by their connecting band. On two Truncatulinas, when examined by aid of the microscope, was found to consist entirely of homogeneous matter; but the other presented a far different appearance. Its segments or zooids, and their connecting bands, all appeared to be enclosed in a well-defined membrane. Each segment was nearly destitute of sarcode, and contained a highly refractive body, in which appeared, with the utmost distinctness, a germinal vesicle or spot. I can regard this body only as a true egg, which has been developed at the expense of the sarcodal element of the segments, in many of which the reproductive process is occurring simultaneously. Yet it may be objected that the ova in the larger segments are greatly larger than the young or original animals of Truncatulina. In some animals, however, as in Spongilla, Gregorina, &c., many individuals are produced from a single egg; and it is not improbable that a process of great division of the egg or swarming may take place in Truncatulina, by which a great number of animals may be produced from each segment.

### II. *Note on the Occurrence of* Trilobites *in the Carboniferous Limestones of Fifeshire.* By R. H. Traquair, Esq. (Specimens exhibited.)

In the neighbourhood of St Andrews, Fifeshire, remains of a trilobite (*Griffithides mucronatus*—M'Coy) are pretty common in the shale overlying the thick bed of limestone worked at Ladeddie, Wilkieston, and Newbigging, and belonging to the Carboniferous Limestone series.

At each of these quarries the limestone itself is hard, blue, and crystalline, and contains but few fossils; but these, consisting of corals, polyzoa, shells, and trilobites, are abundant in the overlying shale, though generally in a very fragmentary condition. This is especially the case at Ladeddie, and, combined with the soft and friable consistency of the shale, renders it difficult to obtain good specimens from that locality. At Wilkieston, however, the shale has assumed a more firm and slaty aspect, and the contained fossils are in a much better state of preservation.

The trilobites occur for the most part in a very disjointed ud fragmentary condition, entire specimens with head, oracic segments, and caudal shield in apposition, being very rarely met with. By far the most abundant relics are the caudal shields, or *pygidia*, which are sometimes found two or three lying together on one small piece of shale. The head is of rarer occurrence; it is sometimes found entire, but very frequently disjointed, the *glabella*, or central part, lying apart from the two lateral cephalic shields. Of entire trilobites I found one very good specimen (in the extended position) at Wilkieston, and two doubled or rolled up (after the manner of certain *Oniscidæ* when alarmed). Mr Walker, of the University Museum, St Andrews, showed me also a very good specimen of the entire animal extended, which he obtained at Ladeddie.

### III. *Note on the Exposure of the Liberton Old Red Sandstone Conglomerate Bed, in a Quarry recently opened near the Grange House, Newington.* By ANDREW TAYLOR, Esq.

The existence of the conglomerate, only visible for a few yards at Liberton Brae, and sinking to the E.S.E. at about 35°, was noted, so far back as 1839, by Cunningham, in his prize essay on the Geology of the Lothians. In the excellent descriptive catalogue of the rock specimens in the Jermyn Street Museum, Mr Geikie catalogues this rock as a calcareous conglomerate; being one of the passage beds between the Old Red Sandstone and Lower Carboniferous series; the basis being stated to be a calcareous sand, with the pebbles generally well rounded, and consisting partly of a compact, Grange House, a quarry has recently been opened, in which a conglomerate, precisely similar in mineral composition to that of Liberton Brae, is disclosed. The bed has been opened at its outcrop with the surface; and this may be traced as an elevated ridge, running nearly in the direction of Professor Syme's villa on the one hand, and Marchbank on the other. The dip of the exposed beds, about 25°, is N.E., similar to that of the Grange Quarry. The mineralogical character of the bed varies very much even in the small space exposed. For while the conglomerate structure is manifest in that part in proximity to Grange House, the exposed beds in the Morningside direction exhibit the appearance of a coarse-grained sandstone, with here and there a pebble interspersed,—in short, very much the structural appearance presented by the lower beds of the old Grange Quarry, situated a short distance above this new one. The exposed beds we are describing are generally very fissile; several vertical dislocations are exhibited; they are five feet in depth, being bounded below by a seam of brownish yellow clay, very similar to that exhibited beneath the greenstone of Salisbury Crags. The direction of this bed, which is generally synchronous with the rest of the Lower Carboniferous series surrounding the city, and its position being considerably beyond the supposed fault, skirting the valley of the Braids, throws great doubt on the stratigraphical importance assigned to the Liberton conglomerate. Both beds evidence a rapid current, carrying with it *debris* from the outlying flanks of the Braids and the Pentlands; but that they are the passage-beds of one great life system into another, has by no means been proved. The method of seeking the classification of the English carboniferous beds in the Scottish system, neglecting the physical proofs whether such beds really exist, has done much to involve in confusion the physical geography of Britain during the Coal era. The appearance of the Liberton bed at the Grange may be chronicled, then, as one more fact tending towards the conclusions of that increasing class of geologists who hold that the Scottish and Irish carboniferous beds are not on the same geological horizon with those of England, but belong to an earlier age, which the progress of palæontology may yet demonstrate to have a closer affinity to the Devonian than the true Carboniferous system.

## IV. *On the Occurrence of the Argentine, Anchovy, and other Fishes, on the Coast of Caithness; with a Note on the Termination of the Vertebral Column in the Tails of the Salmon tribe.* By CHARLES W. PEACH, Esq., Wick.

(Muller's Topknot was exhibited, and also specimens of the tails of salmon, smolt, and trout, showing the upward terminal turn of the vertebral column.)

### 1. Scopelus Humboldtii. (Cuvier.) *The Argentine.*

A fine specimen of this really handsome little fish was picked up on Shaltigo beach, Wick, on the 15th January last, by Mr William M'Leod, pilot. He had kept it in his pocket for a day or two before giving it to me, and shown it to many as the young of the herring. It is somewhat injured in the fins by the handling, but, on the whole, is in pretty good condition. The spots on the lower part of the body are very distinct; the row above these not so clear; those on the head and gills perfect. Its length about 1⅞ inch, depth nearly half an inch. When examining it to observe the fins, a great deal of oil oozed out of it, covering large spaces on my fingers. In the second edition of Yarrell's "British Fishes," 1851, pp. 161 to 168, I find that it has been taken at Orkney, Firth of Forth, Yorkshire, and nets during the herring fishing season. I have seen two very fine specimens. This is considered a dangerous fish, and fishermen stung by it have been lamed for life. In some countries there is a law compelling the fishermen to cut off the dorsal fin before bringing them ashore, under pain of a penalty if they neglect doing so.

3. Trachinus Vipera. (Cuvier et Valenciennes.) *Lesser Weever.*

Common in the sand at times at the back of the pier here, and as well in other localities. In Cornwall this is called "a bishop." As people are often stung by these fishes, I hope it will not be considered trifling if I mention an excellent and almost instantaneous remedy for these wounds. Many boys were cured by me in Cornwall when they had caught these Tartars, by applying sweet oil with some laudanum mixed with it. I never knew it to fail. The belief there is, that any one thus wounded will get no relief from the pain and swelling until after the going down of the sun: this remedy has shaken the superstition. I have met with a similar belief in many other places, not only as regards the sting of the weever, but of the bite of snakes.

4. Engraulis Encrasicolus. (Fleming.) *The Anchovy.*

A fine specimen of this great delicacy was taken off here in a drift-net amongst herrings in August 1860. I am indebted to Mr David Gunn of this place for it. It is common in the Mediterranean, occurs occasionally on the coast of Norway, and in the Baltic, "but is not mentioned by Dr Johnston as having been taken on the coast of Berwickshire, nor does Dr Parnell include it in his fishes of the Forth." This capture adds another locality.

5. Monochirus Linguatulus.* (Cuvier.) *The Solenette.*

I have taken this pretty little sole out of the stomachs of fishes, both here and at Peterhead. Having often got it from trawl-boats in Cornwall and Suffolk, I am well acquainted with it. To be certain about those got in Scotland, I tested the scales under the microscope before admitting them to my list.

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* This fish was added to the list of fishes taken in the Firth of Forth, in the last Report of the Committee on Marine Zoology of the Society.

6. **Rhombus Hirtus.** (Yarrel.) *Muller's Topknot.*

I am indebted to my friend Mr Dick for a fine specimen of this curious fish. It was taken in the Pentland Firth off Thurso. The under-side of the specimen is perfectly smooth. It measures 7¾ inches in length, by 4¾ inches in its greatest breadth.

7. **Orthagoriscus Mola.** (Schneider.) *The Short Sun Fish.*

8. **Lamna Cornubica.** (Cuvier.) *The Porbeagle.*

Seldom a herring fishing passes without specimens of both being captured in the nets, &c. Last year the sun fish was rather abundant. It is often lifted by its fins into boats when basking in the sun.

As it is not my intention now to give a list of all the fishes observed by me on this coast, I shall conclude, by way of tail-piece, with a few words on some of the last joints of the vertebral column of the salmon tribe, for they, like the tail of Luath's dog, have an "upward curl." Some months since I was eating for breakfast a trout, when, to my surprise, I found that it had a crooked tip to its vertebral column. Since then I have found this to be constant in trout of all sizes, whether from rivers, lochs, or the sea; and that salmon, from the smolt to old age, have it also, as may be seen by the tails herewith sent. The three last joints of the vertebral column take a turn towards the edge of the upper lobe of the tail, the tip of the last joint is pointed, and from it a strong cartilaginous cord is continued mation, and, if new, examine for themselves. I ought to observe, that I am quite aware that this upward turn is, as a fœtal one, well known: it is of adult fish that I now speak. Whether new or not, it appears to have escaped Cuvier's notice, for he says, "The one-sided condition of tail exists in no recent osseous fish known to naturalists, except the bony pike,—a Sauroid fish of the warmer rivers of America." Such is no longer the case, for the trout and salmon of our coast must be added to it; not having had an opportunity of examining any other of the Salmonidæ, I cannot say whether this peculiarity runs through the whole family.

The Secretary exhibited several diagrams in illustration of some of the various degrees of change, which appear to have taken place in the caudal termination of the vertebral column of fishes, from the Silurian periods to those of our own day.

It was stated that Professor Goodsir had been in the habit for many years of exhibiting and describing, in his lectures on comparative anatomy, the upward terminal curve* of the vertebral column in the tail of fishes. It was a fact long known to Knox and to other anatomists here. Mr Peach, however, had the merit of discovering a fact, previously unknown to himself, and of calling special attention to it, in relation to the fossil fish of past ages.

### V. *Ornithological Notes.*

#### (1.) Larus glaucus. *Glaucous Gull.* By P. A. Dassauville, Esq.

Mr Dassauville exhibited a specimen of the glaucous gull, *Larus glaucus* (Temm), sent by Mr Small, bird-stuffer. It was recently shot by R. J. Hebden of Eday, Esq., Orkney, and appears to be in the pale yellowish grey mottled plumage of its second winter. The bird is rare, and is not known to breed in any part of the British Islands.

#### (2.) Cygnus Bewickii. *Bewick's Swan.* By John Alex. Smith, M.D.

Dr Smith exhibited a fine specimen of our smallest British swan, *Cygnus Bewickii* (Yar.), which was killed on Loch

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* *Vide* Handbuch der Zootomii von V. Siebold und von Hermann Stannius. Berlin, 1854.—Ed.

Lomond in the beginning of January last. The bird was sent by Sir James Colquhoun of Luss, Bart., to Mr Small, bird-stuffer, for preservation. Bewick's swan is distinguished from the other swans by its smaller size, and by the yellow spot on the base of the bill, which colour, however, does not reach to the nostrils. *Irides* orange-yellow. Bewick's swan does not appear to be common in Scotland, or it may not have been distinguished in many cases from the common wild swan or Hooper.

Of the four swans noticed in Britain, two—the Hooper and Bewick's swan—have the base of the bill yellow, and the front black; and have the trachea elongated, and a loop of it enclosed in the dilated keel of the breast bone. The other two —the Mute swan and the Polish—have the base of the bill black, and the front yellow, and have apparently no elongation of the trachea, and no enclosure of it in the breast bone.

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*Wednesday, 27th March* 1861. Thomas Strethill Wright, M.D., President, in the Chair.

The following gentlemen were elected Members of the Society:—Mr Hugh Fulton, Deputy Harbour-Master, Granton; James Struthers, M.D., Charlotte Street, Leith; John Wilson, Esq., Janefield House, Duddingston; Alexander Logan, Esq., Teind Office, H.M. General Register House.

As Non-Resident Members:—Robert Logan, Esq., Surgeon, Lanark; and Rev. John Struthers, Minister of Prestonpans.

The following donations to the Library were laid on the table, and thanks voted to the donors:—

sembling so closely, in that state, the larva of the common *Cheimatobia brumata*, as to be almost undistinguishable.

### II. *Remarks on some Comparative Anatomical Distinctions between the Skull of the* Manâtus Senegalensis *and that of a* Manatee *from the Bay of Honduras.* By JAMES M'BAIN, M.D., R.N. (Specimens exhibited.)

The skull of a Manatee from the Bay of Honduras, which I now exhibit to the Royal Physical Society, was presented to the Hunterian Museum of Glasgow about seventeen years ago, along with a considerable portion of the skeleton, by Mr James Banks, late of Belize, Honduras, but latterly residing at Prestonpans.*

In the remarks which I shall have occasion to make on this skull, it will be necessary to refer to the "Notice of a Skull of a Manatee from Old Calabar," which I read at a meeting of the British Association at Aberdeen in September 1859, and which was published in the Proceedings for that year.

In the skull from Old Calabar, which I have brought here for comparison, the occipital bone, petro-mastoid, and tympanic bulla, are wanting; and in the skull from the Bay of Honduras there is a transverse section at the base of about an inch in breadth, extending across between the tympanic bones, which involves the loss of nearly the whole basi-occipital. It is in this lost part that several of the principal foramina at the base of the skull are situated.

That portion of the crista interna formed by the inner tables of the frontal bone, extending upwards and backwards from the largely developed crista galli of the ethmoid in the skull from Old Calabar, is almost wanting in the skull from Honduras. The parietal part of the crista interna in the latter skull is well-marked, increasing in size backwards until it expands into a large internal occipital protuberance, with a broad transverse ridge which separates the cerebrum from the cerebellum. The palate of the skull from Honduras, measured from the incisive edge of the premaxillary bones to the posterior part of the spinous cleft of the palate bone, is 8½ inches; from this point of the palate bone to the posterior edge of the basi-sphenoid, the distance is 2½ inches; the length from the incisive edge of the premaxillaries to the coalesced basi-sphenoid and basi-occipital is, therefore, 11 inches, or half an inch less than in the skull from Old Calabar; and from the anterior border of the premaxillary bones to the anterior edge of the foramen magnum, the total length at the base of the Honduras skull is 13 inches. The pterygoid bones are 2½ inches in length, with a smooth outer ridge behind, and another inner ridge, which terminates in a short obtuse hamular process. They coalesce with the pterygoid processes of the palate bone, which are large, twisted backwards and outwards, and cover, without concealing, the posterior aveoli.

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* I regret to see a notice of Mr Banks's death in the "North British Advertiser," as having occurred at Prestonpans on the 6th instant.

The foramen magnum is oval transversely, 2 inches from side to side, and an inch and a half from above downwards. The occipital condyles are $1\frac{8}{10}$th inch in length, and $1\frac{2}{10}$th inch in breadth, and approximate to each other in front. The paroccipital wings at the posterior roots of the condyles expand upwards, inwards, and outwards, in a broad semilunar form, convex above and concave below, where they join the less prominently developed mastoids.

From the posterior edge of the foramen magnum, along the perpendicular occipital spine, to the large straight transverse occipital ridge, the distance is $2\frac{8}{10}$th inches; and from the middle of the occipital crest to the anterior incisive margin of the premaxillary bones, following the curve of [illegible] row at first where they bound the upper part of the temporal fossæ, but gradually spread out into thick, broad, triangular-shaped orbital plates, convex above and concave beneath, to form the roof of the orbital chambers. These orbital plates are larger than in the African skull. The premaxillary bones are 7 inches in length, and extend backwards at the inner edge of the orbital plates of the frontal bone for about 2 inches in the skull from Old Calabar; the premaxillaries are much smaller, less deflected in front, and terminate behind at the anterior part of the frontal bone. The distance from the incisive edge of the premaxillaries to the fore part of the orbital cavities is 5 inches, or an inch less than in the African skull. The orbital cavities are larger and more rounded in the Honduras skull than in that from Old Calabar. The length of the zygomatic process is 5 inches, or half an inch less than in the African skull; it is also much less massive, more curved and concave below. The glenoid surface is more elevated, with two deep depressions at the under and back part, which are but very slightly marked in the African skull. The malar bone is 6½ inches in length, and extends from the outer edge of the glenoid ridge to the anterior part of the orbit. It has a narrow zygomatic process behind, which gradually expands into a broad vertical maxillary process, which terminates in a twisted curved horizontal orbital plate, to form the outer part of the floor of the orbital cavity; and this orbital plate rests on a similar curved orbital process of the superior maxillary bone. The inner part of the floor of the orbits is formed by a bridge-like process of the orbital plates of the superior maxillary bones, which extends outwards from the alveolar processes of the upper jaw. There is a large infra orbital foramen, about an inch in diameter, opening directly in front. The anterior nasal aperture is considerably larger in the American than in the African skull, although the extreme length and breadth of both is almost the same. In the African skull the aperture is contracted from side to side, both before and behind; and as the nasal fossa is narrower, shallower, and altogether less capacious, the size of the anterior nasal aperture appears less than it really is. The frontal and premaxillary bones, as already described, are much larger in the American than in the African skull; and as the parts of these bones which form the boundary of the anterior nasal aperture are also broader, thicker, and more expanded from side to side, there is a corresponding difference in form and size of the anterior nasal aperture in the two skulls. The posterior nasal aperture is somewhat less in the American skull.

The left bulla tympani is present, but without any opening; it is of an oval shape, keeled beneath, an inch and a half in length, an inch broad, and rather more than half an inch in thickness. It is attached in front by a short twisted process to the anterior portion of the pars petrosa, and by another larger transverse process behind. There is a deep oval depression at the upper and back part, a third of which is open above and a little in front, the roof being formed by the under concave surface of the anterior process of the petrous bone, which is lodged in a deep cavity at the under and back part of the root of the zygomatic arch. The pars petrosa and the posterior process occupy another depression, formed partly by the root of the zygomatic process and partly by the mastoid bone. The posterior process of the pars petrosa slightly projects externally by a transverse opening more than an inch in length, and half an inch from above downwards, situated between the occipital and mastoid bones, corresponding to the position of the foramen ronoid process is nearly 4 inches, the upper border of the coronoid process rising two-thirds of an inch higher than the condyle. The maxillary canal greatly exceeds in size that in the African skull, and is not separated from the inflated extremity of the alveolar process posteriorly. It terminates in front in a wide-grooved foramen menti, with another foramen behind, which communicates with the maxillary canal, and is equal in size to the true foramen menti in the African skull. The distance from the angle of the lower jaw to the symphysis menti is about 4 inches, and the angle of the jaw is but slightly inflected, whilst in the African skull there is an acute inflected angle, the two inner points of the angles being only $3\frac{2}{10}$th inches apart. In the lower jaw of the skull from Honduras, the distance between the two inner points of the angles is $4\frac{3}{10}$th inches.

The alveolar process of the lower jaw is 5 inches in length, slightly curved outwards and upwards at the posterior termination, where it perforates the roof of the coronoid process, and protrudes by its inflated extremity into the maxillary foramen.

There are eight molar teeth on the left side of the lower jaw, and an empty socket in front; each tooth has two large transverse bi-tuberculated ridges, and a smaller ridge behind, implanted by two roots in sockets about an inch deep, like those in the lower jaw of the African skull. The roots of the teeth are flattened transversely, corresponding to the transverse coronal ridges, and the posterior root is bifurcate at the apex.

The molar teeth in the upper jaw have two transverse trituberculated ridges, with a ridge-like thickening at the cervix anteriorly and posteriorly, similar to, but less in size than those in the African skull. Each molar tooth in the upper jaw has three roots, the inner root compressed longitudinally, the two outer roots compressed transversely; but the roots of the teeth are less divergent, and the external anterior root is less curved backwards, than those in the African skull. The three posterior teeth on each side of each jaw are nidamental; the three succeeding teeth are but very slightly worn; whilst those in front, still *in situ*, have their crowns much worn down and hollowed out in the middle, showing the central brown dentine, surrounded with a coat of enamel, and a slight outer layer of dark coloured cementum.

There are fifteen molar teeth remaining in the upper jaw, and fifteen in the lower, with six distinct empty sockets; the dental formula in the skull from Honduras is, therefore, $m\,\frac{9-9}{9-9} = 36$. It appears to have been from the American species, the *Manátus australis* of the British Museum Catalogue, that Daubenton, Cuvier, Gray, and others, have adopted the dental formula of the genus Manátus. In the British Museum Catalogue for 1850, the number of grinders in the genus Manátus is said to vary according to the age or state of the specimens, but when complete to be $m\,\frac{9-9}{9-9} = 36$. It is added that the front ones are often deciduous; hence Sir Everard Home describes them as $m\,\frac{6-6}{6-6} = 24$, and Cuvier as $m\,\frac{8-8}{8-8} = 32$.

There is no skull of the African species mentioned in the Catalogue as existing in the British Museum; and there is none described in the Catalogue of the Royal College of Surgeons of London; and at a meeting of the British Association held at Cheltenham in 1856, Professor Owen stated, that he had not then had an opportunity of examining the was found to be present in the skull of the *Manâtus senegalensis*, which inhabits the rivers at Old Calabar.

### III. *Historical Review of the State of our Knowledge respecting Metamorphism in the Mineral Kingdom, with special regard to certain recent Researches.* By JOHN S. LIVINGSTON, Esq.

Mr Livingston stated, that within late years great additions had been made by the labours of chemical geologists to our knowledge of the more recondite geological phenomena. To these additions he wished to direct the attention of the Society, as they seemed in this country to have, in a great measure, escaped notice. After expressing his opinion that, if we are to make any advances in our knowledge of the deep-seated causes of metamorphic changes, it must be brought about by introducing into the methods of geological research much more of the experimental than had hitherto been considered necessary, he rapidly sketched the progress of inquiry into metamorphism. Every year was enabling us more and more to imitate the mineral productions that occur in nature, though we cannot reproduce all the conditions under which they were formed. What the influence of the long lapse of ages might have been, must of course ever remain an insoluble problem. After passing under review the opinions of Hutton, Mr Livingston referred to the experiments of Sir James Hall, but especially to his having succeeded in producing a crystalline marble, by placing powdered calc spar in a gun-barrel hermetically sealed, and exposing it to a high temperature,—an experiment that had been recently impugned by Gunstav Rose, but on insufficient grounds. Reference was then made to the processes adopted by Berthier, H. Daville, and Caron, for artificially producing minerals by fusion alone, and especially to the production of corundum by Ebelman. But the most important results were obtained when Senarmont, by experimenting on minerals with water at high temperatures, and under enormous pressures, produced crystalline quartz, spathic iron, sulphate of baryta, and sulphide of antimony. Daubrée in 1857 had, by using a temperature of 572° Fahr., converted wood into anthracite; and Baroulier in 1858 obtained coal by placing vegetable matter in moist clay, and exposing to heat. Daubrée's observations made at the thermal springs of Plombières were next mentioned. These issue, with a temperature of about 172° Fahr., from a porphyritic granite in the mountains of the Voges. To convey the water of the springs to the baths, which the Romans had built there, a structure of brick and sand had been erected. Through this the water had trickled. On breaking into the mass numerous minerals of the zoolite family were found, but chiefly Apophyllite and Chabasite. Mr Livingston then mentioned the extensive changes effected by the juxtaposition of certain rocks, and especially the phenomenon termed Endomorphism by Fournet. He then discussed the bearing of these and other facts, and showed that, though the hypothesis of a central fire would undoubtedly explain much, yet that it would not all. If heat were the only agent in these changes, he asked why did they not take place according to the known laws of the propagation of heat and the conductibility of rocks? That water had to do in effecting these changes was evident from the occurrence of chiastolite, augite, garnet, and felspar in sedimentary rocks. The presence of water chemically combined in the masses ejected by volcanoes was a proof that it played an important part in the phenomena that take place at great depths. He then referred to the facility with which minerals, and especially the silicates, can be formed when water is present, to Dau-

*Wednesday, 24th April* 1861.—ALEXANDER BRYSON, Esq., President, in the Chair.

The following gentlemen were balloted for, and elected non-resident members of the Society:—

The Rev. George Gordon, LL.D., Manse of Birnie, Elgin; Lieutenant-Colonel George Logan Home, K.L.H. and K.R.G., of Broom House and Edrom, Dunse.

The usual Committees were appointed for special investigations during the summer.

*Memorial against Salmon Fisheries Act.*—Mr GEORGE LOGAN, Convener of the Committee on Marine Zoology, read a memorial to the Lord Advocate, which had been prepared, praying for various alterations on his proposed Salmon Fisheries (Scotland) Act 1861, which, unless the prayer of the memorial was granted, would put a stop to a considerable part of the means used by the Committee in investigating marine zoology. The memorial was approved of, and powers were granted to the Committee to use its best endeavours to get the prayer of the memorial carried into effect.

The following donations to the Library were laid on the table, and thanks voted to the donors:—

1. Proceedings of the Royal Society of London. Vol. X., 1859–60, and Part I. of Vol. XI.—From the Society. 2. Proceedings of the Academy of Natural Sciences of Philadelphia. 1860. 3. A Notice of the Origin, Progress, and Present Condition of the Academy of Natural Sciences at Philadelphia. By W. S. W. Ruschenberger, M.D. 1860. —From the Society. 4. The Quarterly Journal of the Geological Society. No. 64, November 1860, Vol. XVI., Part IV., and No. 65, February 1861, Vol. XVII., Part I.—From the Society.

The following Communications were read:—

## I. *Some Statements in Cuvier's "Natural History of Fishes," as to the Herring, shown to be erroneous.* By J. M. MITCHELL, Esq.

Mr J. M. Mitchell stated that he had observed several errors in some of the principal works on natural history as to the herring, which he might afterwards more fully discuss; but in the meantime he would point out some erroneous statements in Baron Cuvier's "Histoire Naturelle des Poissons," edited by Professor Valenciennes. In the twentieth volume of the quarto edition, page 35, it is said, "that in the northern seas, as far as the White Sea, all the individuals have an invariable largeness, always superior to that of our herrings of the Channel, of which the small dimensions are equally constant." Now, he said, it was true that considerable shoals of large herrings do appear on the Norway coast in the winter and spring; but the author seems not to have been aware that there is always in summer considerable shoals and a large fishery of small herrings, generally of a superior quality, but of a smaller size on the average than those caught in the English Channel (*La Manche*) or on the Scottish coasts; and he exhibited a specimen of each size, the one a giant of 13½ inches, and the other a dwarf of about 9 inches, each with the ova fully developed, and said that any number of each size could be obtained. He alluded to the statement in the same work as to the exceedingly deciduous nature of the scales of the herrings, and said that this was an exaggeration, as was evident even from the specimens he produced, which were covered with their scales. It is stated in this work, that the herring spawns apparently indiscriminately, without selecting any position, even in the middle of the sea—" au milieu de la mer." But this is not the case; for Mr Mitchell had ascertained that the herring always selects rocky, stony, or gravelly ground, on which to deposit its spawn. He would also point out that at page 62, vol. xx., it is said, " c'est pendant l'hiver qu'ils appairrissent sur les côtes d'Europe." Now, it is well known that great shoals of herrings approach the coasts of Europe in state of the *sarcode* as occurring in spirit specimens of *Orbitolite*, which appeared to be broken up into little spherules, though still retaining the structure of unchanged sarcode. He also states that similar spherules are figured by Ehrenberg in several of the cells of *Sorites orbiculus*, and by Schultze in the chambers of *Rotalia.* Dr Carpenter is inclined to believe that these bodies are gemmules. I have repeatedly noticed bodies, apparently similar to those figured by Carpenter, in *Gromia ;* but I have considered them to be of the same nature as the coloured spherules which are found within the endoderm of the Hydroid Zoophytes.

Besides these spherules, however, Dr Carpenter has met with other bodies, apparently imbedded in the sarcode, which he considered might be gemmules in a later stage, or ova. These were of a deep-red colour, and exhibited various stages of binary division. He has also figured a third object, found in an imperfectly closed shell of *Orbitolite*, which, with his usual caution, he considered might possibly have been introduced from without.

It is under these circumstances that I bring forward the following observations.

With regard to the female element, it will be necessary first to ascertain the essential characters of an ovum. Professor Allan Thomson* defines it as " a detached spheroidal mass of organised substance, of variable size, enclosed in a vesicular membrane, and containing, in the earlier periods of its existence, an internal cell or nucleus." But the presence of a nucleus is not essential to the constitution of an ovum ; for in the ova of *Chrysaora hyoscella* and some of the Ctenophora (*Beroë*) it cannot be detected at any stage. The ova of these animals may be defined as " detached masses of highly refractive substance." Such appears to be the simplest definition of an ovum—a definition which will apply also to the first stage of the ovum of *Rhizostoma* as figured by Professor Thomson,† where he shows, first, the " primitive ovum" destitute of germinal vesicle and spot ; secondly, the appearance of the germinal vesicle ; thirdly, the advent of the macula within the vesicle; and, lastly the formation of the enclosing membrane.

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* Cyclopædia of Anat. and Phys., vol. v. p. 128.

† *Op. Cit.* p. 128.

On examining a great number of specimens of *Gromia*, *Miliolina*, *Rotalina*, and *Orbulina*, I have repeatedly discovered bodies which correspond in all respects with the "primitive ovum" defined above. They consist of transparent spheres or ovoids formed of a finely molecular substance, but in which the molecules are masked or rendered indistinct by the highly refractive matter in which they are imbedded. No germinal vesicle or spot appears in the living specimens. It may be masked in a similar manner to the molecular structure; but in a specimen of *Truncatulina* (Pl. IX. fig. 6) which has been hardened in spirit, decalcified by dilute nitric acid, and mounted with strong heat in Canada balsam, four of the segments or zooids contain each an ovum which shows a germinal vesicle and spot with the utmost distinctness, while the rest present the usual appearance of granular, low-refracting sarcode.*

I have not been able to trace the development of the ova of Rhizopods. Bodies similar to those I have considered ova in *Gromia* are found attached to Algæ in vessels where that animal abounds. The ova of *Gromia* are very small; and young Gromias slightly larger than the ova also occur. In *Gromia*, therefore, the ova may be at once transformed into young, and directly acquire an envelope. Such is the mode of development in the ova of most of the Hydroidæ, zooid of the adult. It is therefore probable that the ova of these genera undergo a "polymorphic" development of many months' duration, similar to that described by Carter as occurring in *Amœba verrucosa*,* and that each ovum becomes transformed into numerous Amœboid zooids, which escape through the openings of the shell and form the primordial segments of future Rhizopods.

With regard to the male element, I have only one observation to record. Amongst a large number of dark-brown Gromias which I have possessed for many months, one appeared filled as to its upper part with a milky matter, which, when pressed out, proved to be a congeries of cells and large active molecules, such as are obtained from the sperm-sacs of *Hydra viridis.* I was not able to make out the tails of the spermatozoa; but there could be no mistaking the characteristic shape and movements of the cells and molecules. The sarcode of the body in Rhizopods is itself finely molecular in structure, and, when crushed, exhibits slight molecular movements; but these movements are altogether different from those of the objects which I am persuaded are the spermatozoa of *Gromia.*

Since the foregoing paper was sent to the press, I have received the April Number of the "Annals," in which Schultze's discovery of living young in the chambers of *Rotalia* is brought before the readers of this Journal. Professor Williamson, in his "Treatise on Recent Foraminifera" (Ray Soc. Publ.) states, in regard to his *Spirillina perforata*, "He (Professor Ehrenberg) assigns to it the trivial name of *vivipara,* owing to the circumstance that just within the septal orifice of his specimen he found two small spiral shells, which had obviously found their way there by accident; from this unimportant circumstance, he concluded that the shell was viviparous." *S. perforata* is plentiful in the Firth of Forth, on *Fucus serratus.* Immediately after reading Schultze's paper, I examined a quantity of the seaweed, and found two large specimens of *S. perforata* surrounded by a multitude of very small ones. In one of the large specimens three small living *Spirillinæ* existed. Ehrenberg was doubtless right in considering this animal viviparous; but it remains to be determined whether the young are produced by gemmation or ovulation. In *Spirillina foliacea* I have found the highly refractive bodies I have above described as "primitive ova."

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* Ann. Nat. Hist., ser. 2, vol. xx. p. 87.

*Explanation of Plate* IX.

Fig. 6. Specimen of *Truncatulina*, decalcified; *a*, membranous basis of shell; *b*, sarcode; *c*, ovum, with germinal vesicle and spot; *d*, segment or zooid destitute of ovum.

### 2. *On the Reproduction of* Ophryodendron.

*Ophryodendron abietinum*, which I have figured in various attitudes in Pl. X., has been noticed elsewhere by Claparède and Lachmann* and myself† several years since; but it was not until the spring of the present year that I was able to discover its mode of reproduction. The animal presents the appearance of an oblong sac filled with homogeneous and finely molecular matter, and is found attached to the corallum of *Sertularia pumila*. From one end of the body or sac arises a proboscis, generally appearing as a short and closely-wrinkled club, but capable of being produced to a remarkable distance as a glassy ribbon surmounted by numerous twining tentacles. The sac usually shows no trace of a nucleus or contractile vesicle, nor are its contents differentiated into an external and internal tissue (ectosarc and endosarc), as in *Actinophrys* and others of the class ("Acinétiens") into which it has been introduced. The suspended or floating in an erect position, or slowly swims about in large curves by the continuous and very active motion of its tentacles. This animal may be called the homomorph, amongst the Protozoa, of *Sipunculus Bernhardi.* I have never been able to satisfy myself as to its mode of feeding, though portions of matter are occasionally seen entangled amongst the tentacles, and apparently pressed in contact with the substance of the proboscis.

In the sketch of this animal appended to my notice of 1859, I figured several globular bodies within the sac, which my friend, M. Claparède, to whom I showed it, had not observed; and on further observation, I was led to consider the figure erroneous. In March last, however, the *Ophryodendra* (Pl. XI. fig. 1) again contained these bodies, and by a somewhat "meddlesome midwifery," I was enabled to force them from the sacs, and to find that they were living young, from four to nine in number.

The young thus obtained consist of ovoid bodies of higher refractive structure than the body of the parent, and contain olive-brown corpuscles, shaped like the chlorophyll-granules of *Hydra viridis.* At a later stage, when the wrinkled trunk of the parent hung lax and dead, the young larvæ assumed a pyriform shape, flattened on their inferior surface (Pl. XI. fig. 2). This surface was also marked with longitudinal striæ, carrying short, soft, slowly-moving cilia or processes. Their natural mode of extrusion was not observed; but several families of them were found, each enveloped in a soft gelatinous ball, and attached to the *Sertularia* and other bodies. Single individuals were seen slowly moving on the zoophyte, and others attached were putting forth the rudiments of the proboscis. The proboscis was at first finely molecular, like the contents of the sac, unwrinkled and non-contractile. A few tentacles were presently put forth from its summit (fig. 3), and it gradually assumed the structure of that of the adult.

The body of *Ophryodendron* frequently bears fusiform bodies, from one to four in number, which I have already described, and which appear to be gemmæ.

*Explanation of Plates* X. *and* XI., *figs.* 1–3.

Pl. X. Two cells of *Sertularia pumila*, on which *Ophryodendra* are attached,—the figure on the left side of the centre with gemma and contracted proboscis, that on the right side of the centre with proboscis extended; the trunks of two others are shown in various stages of extension.

Pl. XI. figs. 1–3. Young of *Ophryodendron* in various stages of development.

### 3. *On* Dendrophrya radiata *and* D. erecta (nov. gen. et sp.).

The Rhizopodous animals to which I have given the name of *Dendrophrya* are found plentifully on Sertularias, Flustras, Fuci, and stones, in low water pools at Granton Quarry, near Edinburgh. There are two species, *D. radiata and D. erecta.*

#### *D. radiata.*

Its general appearance is that of a small shelly mass, from the borders of which radiates a system of branched membranous tubes, more or less coated with mud or other matters. In young specimens the central shell is absent, and the animal presents the appearance of an irregular system of branches radiating from a centre. The shape of the adults is very various, and depends on the surface to which they are attached; they attain sometimes a diameter of nearly a quarter of an inch, though generally much smaller. The shell is not acted on by acids, and is therefore siliceous. The animal itself can seldom be detected, as it lies concealed within its central flinty stronghold and the complicated system of earthworks surrounding it.

differs from the sarcode of other Rhizopods in being filled with delicate short fibres instead of the usual molecular matter, and contains, both within the shell and tubes, the highly refractive bodies I have mentioned in a former paper as ova.

*Explanation of Plate* XI.

Fig 4. *Dendrophrya erecta* seated on a portion of stone, and showing pseudopodia projecting from summits of branches.

Fig. 5. Summit of one of the tubes of *D. erecta*, with projecting lobes of sarcode and pseudopodia.

### 4. *On* Lecythia elegans (nov. gen. et sp.)

This animal, of which I give drawings in Pl. XII. fig. 10, is found on *Sertularia pumila.* It is exceedingly minute, and requires high microscopic power and careful adjustment of light for its accurate definition. The body is flask or carafe-shaped, mounted on a long, fine, rigid pedicle, and enclosed in a closely fitting envelope. The summit of the body is dilated, and furnished with a variable number of long, slender, divergent processes or tentacles, which appear to correspond with those of *Actinophrys.* When the tentacles are contracted, they become capitate, and assume the form of a bossed crown, as shown in the figure.

### *Appendix to* Cionistes reticularis (Kionistes retiformis), printed at p. 91.

This zoophyte resembles the Sertulariadæ in the simple columnar form of its non-tentacled reproductive polyps, and forms the connecting link between these organs in the Tubulariadæ and Sertulariadæ. It exhibits the most degraded form of the reproductive polyp, previously to the latter being altogether dispensed with and the generative sacs being developed directly from the polypary. Thus we have, in the chain of degradation,—

| | |
|---|---|
| Generative sacs or medusoids attached to ordinary alimentary polyp, as in . . . . . . . | *Clava, Coryne,* &c. |
| Generative sacs attached to reproductive alimentary polyp, which differs from ordinary alimentary polyp in having fewer tentacles . . . . . . . | *Podocoryna fucicola* (Sars). |
| Generative sacs attached to reproductive polyp with rudimentary mouth and tentacles, as in . . . | *Hydractinia echinata.* |

| | |
|---|---|
| Generative sacs attached to reproductive polyp without mouth or tentacles; summit of polyp surmounted by a cluster of large thread-cells, as in . . . . . | *Eudendrium confertum* (Alder). |
| Generative sacs or medusoids attached to reproductive polyp without mouth, tentacles, or cluster of thread-cells, as in . . . . . . . . . . | *Cionistes*,<br>*Sertularia*,<br>*Campanularia*. |
| Reproductive polyp divided longitudinally into several portions, each surmounted by its cluster of large thread-cells; sperm-sacs formed, as in *Hydra*, by simple dilatation of the ectoderm; each division of polyp transformed into a "moniliform" sperm-sac, as in . . | *Eudendrium arbusculum* (T. S. W.),<br>*E. capillare?* (Alder). |
| Generative sacs or medusoids attached to the polypary, as in . . . . . . . . . . . | *Atractylis* (T. S. W.),<br>*Hydractinia* (Alder and T. S. W.),<br>*Cordylophora* (Allman). |

It will thus be seen that there is a very gradual transition from the alimentary polyp to the reproductive polyp, and from the latter to the simple generative sac. Professor Allman's term "blastostyle," applied to the reproductive polyp, is apt to mislead, as it indicates that the alimentary and reproductive polyps are not homologous parts. Still more decidedly does that accomplished naturalist confuse the homology of these parts by applying the same term to the branched pedicle of the aggregated generative sacs of *Tubularia indivisa*, which is merely formed of the conjoined and elongated pedicles of the individual sacs.

It is impossible to construct any classification of the Hydroid Zoophytes on the form or position of their generative the polypary; in other species of *Atractylis* they arise from the reticulated base of the zoophyte. In certain species of the genera *Sertularia* and *Campanularia*, marsupial forms occur which bear no homological relation to each other.

The gradual transition in the Hydroidæ from the simple generative sac to the perfect Medusa is exceedingly interesting. I attempt to indicate it in the following sketch:—

| | | |
|---|---|---|
| Generative elements (spermatozoa or ova) contained in a simple generative sac or dilatation of the ectoderm; *placenta* formed of endodermal floor of sac, . . . . . . . . | *Hydra.* | Simple generative sac. |
| Placenta protruding into generative sac, and forming "spadix" (Allman) surrounded by generative elements, . | *Coryne.*<br>*Hydractinia.* | |
| —or branched and permeating them, | *Campanularia lacaerta* (male). | |
| —or folding round single ovum, . | *Eudendrium rameum* (female). | |
| Placenta adherent to summit of generative sac; summit of sac furnished with cluster of large thread-cells; sac the equivalent of the peduncle of *Coryne gravata*, . . . . | *Eudendrium arbusculum* (male).<br>*E. confertum* (female).* | Generative sac become a peduncle ("manubrium," Allman). |
| Summit of sperm-sac furnished with a row of tentacles indicating the presence of a non-differentiated subumbrella, . . . . . . . . | *Laomedea Loveni* male). | Subumbrella present, but not differentiated. |
| Generative sac transformed into a free walking medusoid; peduncle furnished with branched tentacles, as in *Bougainvillea;* subumbrella not differentiated, its presence indicated by eye-specks and otoliths; umbrella absent, | *Eleutheria*, medusoid of *Clavatella* (Hincks). | |
| Ovisac fixed, enclosed in a differentiated subumbrella with lateral and circular canals and tentacles, . . . . | *Laomedea Loveni* (female). | Subumbrella differentiated. |

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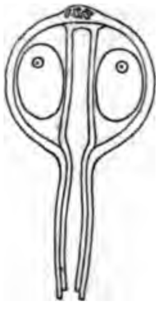
* In the ovisac of *E. confertum* (see figure in margin), which I have had an opportunity of examining through the kindness of Mr Alder, the endoderm and ectoderm at first adhere together at the summit of the sac, and at this point a few large thread-cells occur in the ectoderm. A similar occurrence of adhesion and thread-cells is found in the sperm-sac of *E. arbusculum*, and also in the false and mouthless peduncle of the medusoid of *Coryne gravata*.



| | | |
|---|---|---|
| Sperm-sac surmounted with large thread-cells, and forming the peduncle of a fixed medusoid with differentiated subumbrella and umbrella, . . | *Coryne gravata.* | Umbrella differentiated. |
| Imperfect free medusa; peduncle with tubular mouth, and united with a single-cavitied generative sac . | Medusa of *Coryne decipiens*, *Sarsia.* | Peduncle or alimentary polyp and generative sac not differentiated from each other (see *post*). |
| Perfect free Medusa of low type; peduncle four-tentacled or lipped, and containing eight generative sacs coalescing into four, which are situated alternately with the tentacles or lips, | *Bougainvillea Britannica*, the Medusa of *Atractylis ramosa* (female).<br>*Turris neglecta*, the Medusa of *Clavula Gossii* (female). | Generative sacs differentiated from alimentary polyp, but situated on it. |
| Perfect free Medusa of low type; peduncle four-lipped or tentacled, with eight distinct generative sacs, one placed on the side of each lip, . | *Oceania episcopalis,* | |
| Perfect free Medusa of higher type; peduncle four-lipped or tentacled; eight generative sacs, one on each side of lateral canals, . . . | Medusa of *Laomedea geniculata.* | Peduncle and generative sacs differentiated. Alimentary polyp taking no part in reproduction. |
| | | Generative sacs on sepa- |

the Hydroidæ, any phase—planuloid, polypoid, or medusoid—may be absent.

The perfect several-lipped Medusa appears to be a symmetrical organism composed of eight or more elements, each element corresponding to the half of a lip. Each of these elements is composed of three subelements, the alimentary, reproductive, and prehensile, any of which may be suppressed, or unite with others of different value on the same element, or of the same value belonging to neighbouring elements. Thus, in *Sarsia* the peduncle appears to consist of a single alimentary subelement, and the single reproductive element or generative sac extends around and along the whole of it except the single trumpet-shaped lip. This lip is occasionally placed on one side and at some distance from the extremity of the peduncle, indicating the asymmetrical character of the latter organ in this genus. In *Euphysa* and *Eleutheria* the ovisacs coalesce, and are placed within and at the base of the peduncle. *Steenstrupia* and *Saphenia* furnish examples of the suppression of certain of the marginal tentacles or prehensile subelements, and the exaggeration of others.

The Polyp of the Hydroid Zoophyte must also be considered as composed of one or more elemental zooids. Thus we have the zooid of a single element in the 'tentacular polyp' of *Hydractinia ;* the zooid of two elements in the two-tentacled and two-lipped *Lar Sabellarum* (Gosse) (Pl. XII. fig. 8), and in the minute two-lipped and non-tentacled polyp which occurs on the Antennularias and others; the zooid of several elements in the five-lipped polyp of *Trichydra* (T. S. W.); that of many elements in the polyp of *Tubularia indivisa*, which I have elsewhere shown to be formed by the confluence of the several distinct tubes of which the polypary or cœnosarc is composed, each of which tubes may be traced, by its coloured endodermal ridges, to the mouth of the polyp, and bears its own system of tentacles and reproductive apparatus.

The compound character of the *polypary* is also seen in *Halecium* and *Antennularia*, and in a very beautiful manner in the very early state of *Sertularia pumila*, which (after it had been kept a few days in fresh water) I have figured with the camera in Pl. XII. fig. 12. Its resemblance to Carus's figure of the Medusa, *Cunina globosa* (Esch.), which I have copied in fig. 11, is very striking.

As the Medusa is a multiplex organism, we must inquire how far it is homologous with the generative sac of the Hydroid Zoophyte.

Prof. Allman, in his paper on *Cordylophora* (Phil. Trans. vol. cxliii.), advanced the doctrine that the generative sac was homologous with the whole Medusa—a doctrine based upon an erroneous conception of the cavity in which the generative elements are contained. In a "Note on Diœcious Reproduction in Zoophytes" (Edin. New Phil. Jour., vol. iv. p. 88), I stated that "the reproductive buds [generative sacs] (of *Coryne*) were filled with ova developed from the exterior of a hollow central stalk, a diverticulum of the alimentary canal;" and further, "The *peduncle* of the Medusa-bud [or budded Medusa] appears to me to be homologous with the entire reproductive capsule [generative sac] of *Coryne glandulosa*, &c." This view is now adopted by Prof. Allman, who writes, in "Annals of Natural History," (vol. vi. ser. 3, p. 4), "The manubrium is the whole of the 'peduncle,' 'stomach,' or by whatever other name it may be called, which depends from the centre of the umbrella in a Medusa or medusoid; and I apply the same term to what I consider the homologous part in a sporosac, namely, the whole sporosac *minus* the ectotheca and mesotheca." Now, generative one) having only one function, cannot be homologous with one composed of two subelements (peduncle of *Sarsia*), each having its distinct function, or with an organ of sixteen subelements (peduncle of *Bougainvillea*), eight of which are alimentary and eight reproductive. I would therefore now state—

That the simple generative sac of *Coryne* is homologous with the reproductive subelement or single generative sac as it exists on the lateral canal of *Stomobrachium*.

That the peduncle-like sac of *Eudendrium confertum* is homologous with the *reproductive* subelement in the peduncle of *Sarsia*—not with the whole peduncle.

That where the generative sac evidently consists of many subelements, as in *Tubularia larynx* and *Sertularia fallax* (evidenced by the four summit-lips or lobes, the symmetrical character of each of which indicates it to be composed of two subelements), it is homologous with the *reproductive* subelements in the octopartite peduncle of *Bougainvillea*, or, rather, with the eight coalescing *reproductive* subelements of *Eleutheria*.

I consider that a four-lobed or branched state of the placenta or spadix indicates a multipartite constitution of the generative sac, and not a rudimentary medusoid form of that organ; for we have, in the fixed female medusoid of *Laomedea Loveni*, a four-lobed condition of the placenta in the peduncle-like ovisac, with the existence of a well-differentiated subumbrella and lateral and circular canals.

My space will not allow me to illustrate the homological relations which exist between the polypary (or cœnosarc) and the polypidom on the one hand, and the subumbrella and umbrella on the other. This must be reserved for a future occasion, when I hope to fill up the gaps in this rough and incomplete sketch of some of the morphological relations of the Hydroidæ and their Medusæ.

### *Appendix to* Hydractinia, printed at vol. i. p. 192.

In the "Annals of Natural History" (vol. iv. ser. 3. p. 50) Prof. Allman has remarked, with regard to *Hydractinia*, that "the solid chitinous polypary [polypidom] is covered externally by the cœnosarc [polypary], thus reminding us of the sclerobasic corallum of some of the Actinozoa." This doctrine had been previously promulgated by Quatrefages (Ann. des Sc. Nat., xx. 232), who considered the polypidom to be an endoskeleton deposited in the substance of the polypary, like the solid axis of *Gorgonia.* If this view were correct, it would not only remove *Hydractinia* from the Tubulariadæ, but would segregate it from the whole of the Hydroid Zoophytes, not one of which is destitute of an investing polypidom.

In the "Edinb. Phil. Journal" for April 1857, I stated, in a paper on *Hydractinia*, my conviction of the incorrectness of Quatrefages's opinion, and that the mode of secretion of the polypidom of *Hydractinia* did not differ from that of the rest of the Tubulariadæ, as was seen in the development of its young and its propagation by stolons. Since then I have come to the following conclusions, after the examination of a very large number of specimens, some hatched from the egg and adherent to glass, others removed as cuttings from adult specimens and transplanted on glass, to which they readily grow, and others removed entire from the shell of the *Pagurus* by acid, and put up in spirit or balsam.

The *polypidom* and *polypary* are found in the following forms, all of which are frequently combined in the same specimen:—

1. An open network of delicate chitinous tubes without

endodermal tubes, and covered above and below by a delicate investment of chitine. Found on the growing borders of the zoophyte, and especially in cuttings of old specimens transferred to glass.

The *spines* are composed of one tube or many parallel tubes: they may be single (Pl. XII. fig. 4), and developed on a single tube of the polypidom, like those of *Podocoryne fucicola;* single at their summits and of several tubes at their base (figs. 5 and 6); composed entirely of several (8–12) conjoined tubes (fig. 7); reticulate by the lateral anastomosis of their tubes; or consisting of long ridges of tubes reared against each other.

The polyps spring from one or several confluent tubes of the polypary; they are covered at their origin, and for a little distance above it, by a delicate prolongation of the polypidom. This may be detected by dyeing the whole zoophyte with tincture of kino, which gives different tints to its chitinous and fleshy elements, or by steeping it alternately in spirit and water, when the coverings of the polyps and polypary become inflated as in figs. 2 and 3.

The *polyps* are of several shapes and functions, which I have described in the paper cited above. It will be sufficient to enumerate them here:—

1. Alimentary polyps, with mouth and tentacles.
2. Reproductive polyps, with rudimentary mouth and tentacles.
3. Spiral polyps—a modification of the last; generally barren (fig. 3).
4. Sessile generative sacs of the polypary.
5. Tentacular polyps, or great tentacles of the polypary (fig. 2).

In the reproductive organs of *Hydractinia* there is a gradual transition from the reproductive polyp to the sessile generative sac; the polyp loses its dot-like mouth, its tentacles, its head or upper part, and finally dwindles down to a mere sperm-sac. This change is generally seen in those specimens which have long been kept in captivity. In these specimens, too, many of the alimentary polyps are often converted into large inflated sacs destitute of mouth and tentacles, and showing through their parietes white longitudinal ridges, which indicate the number of zooid elements of which they are composed.

In the natural history of this remarkable zoophyte there are other points of peculiar interest, which, having already described, I need only mention here: the slow development and unique shape of the planuloid larva; the powerful muscular structure of the polyps, especially the spiral ones, the office of which last has yet to be discovered; and the intimate sympathy and combined action which subsist between the various parts of the whole animal.

### III. *Notes on Deep Sea Soundings.* By E. W. DUBUC,* M.D., R.N. Communicated by Mr JAMES B. DAVIES.

The deposits now forming at the bottom of the ocean possess a peculiar interest from a zoological as well as from a geological point of view, especially when we consider the importance of the natural processes upon which they are capable of throwing light.

It is only of late years, however, that we have been enabled with any degree of accuracy to sound the vast depths of the ocean, to map out the varying configuration of the solid substrata, and to examine into the nature of the latter. We owe this in great measure to the invention of an improved form of sounding apparatus by Mr Brooke of the United States Navy.

Owen mentions *polycistinæ* as also occurring in specimens from the bottom of the North Atlantic.

Through the kindness of T. C. Scott, Esq., R.N., I am enabled to lay before you various samples, likewise, from the telegraph plateau, the result of soundings made in H.M.S. Bulldog. They are of a light yellow colour, and effervesce strongly with acid.

In the microscopical slides before you, you will readily perceive numbers of calcareous *foraminifers* of genera resembling *Rotalia* and others; besides there are here and there, but usually in fragments, the beautiful tessellated siliceous shields of *coscinodiscus.*

It is a curious circumstance, that, in many instances the *polythalamiæ* were brought up from the same locality with the soft parts still preserved. Lieutenant Maury conjectures that perhaps the bodies of persons buried in the deep sea may in like manner be preserved for long periods, the great pressure to which they are subjected preventing decomposition, by opposing an obstacle to the separation of gaseous bodies.

Prior to the laying down of the submarine cable between Kurrachee in Scinde and Muscat in Arabia, a number of soundings were made along the proposed route by Captain Pullen in the Cyclops. I obtained two specimens which were brought up, one from a depth of about 200, the other from about 700 fathoms, off the south coast of Beloochistan. The sea is very deep in this locality, especially towards the sea of Oman which parts Beloochistan from Arabia. While the temperature of the air where these soundings were being taken was almost tropical in character, the thermometer attached to the sounding apparatus showed that the temperature at the bottom of the ocean was under 40° Fahr.

The matter collected at 200 fathoms resembles bluish clay. It does not effervesce with acid, and under the microscope it presents to view a number of clear angular fragments, many of them undoubtedly of mineral origin.

The calcareous *foraminifers* so plentiful in the deposits from the North Atlantic are here very rare. After diligent search I could only recognise two or three. Here and there we meet with spiculæ of sponges. There are also present the broken, and, in some cases, perfect valves of the *coscinodiscus*, but any other organisms are too undecided to pronounce upon.

The sample from 700 fathoms is still less abundant in such objects.

Deep sea soundings have now been effected in various parts of the world. Professor Bailey examined specimens brought up in Lat. 56° 46′ N., Long. 168° 18′ E., the depths being respectively 900, 1700, and 2700 fathoms.

They yielded a variable proportion of mineral matter, diminishing as the depth increased, a quantity of the siliceous shields of *diatoms* including *coscinodiscus* and numerous spiculæ, but not a fragment of any of the calcareous *polythalamia*. The beautiful siliceous *polycistinæ* were also observed.

A specimen brought up by Brook's sounding-rod in the coral sea, in Lat. 13° S., Long. 162° E., from the reported depth of 2150 fathoms, afforded many spiculæ of *sponges*, a very few *diatoms* including the *coscinodiscus*, some *polycistinæ*, and a very few fragments and only one perfect *polythalamia* shell.

The deposits now forming at the bottom of the North Atlantic, therefore, differ notably from the latter, in containing so many *polythalamiæ*.

Perhaps at some future date we may be able to discover months of February and March, and he found that any appearance of *herring fry* gradually ceased, while the sprat, *Clupea sprattus*, was most abundant; even the occurrence of young herrings, *i.e.*, fish above five inches long, was rare, until about the beginning of March, when for a day or two they again made their appearance among the sprats in some numbers, and then entirely disappeared. About the 10th of March considerable quantities of very fine pilchards, *Clupea pilchardus*, the gipsy herring, were brought to market, along with herrings and sprats, and the writer of this notice examined some dozens of them. The largest were fully eight inches in length, and might readily be mistaken for herrings, although upon a closer inspection the general aspect of the fish showed marked distinctions even to the eye,—being more slim and delicate, having smaller scales, more firmly attached, and, when compared side by side with the herring, giving one the impression that it might be a young herring which had only just attained maturity. The marked distinctions between this fish and the herring need not be repeated; Dr Parnell states them most accurately, and says that it had been of late (when he wrote in 1839) a very rare fish in the Firth of Forth, as well as along the whole eastern coast of Scotland; while, about thirty years previous, it had been as plentiful as the common herring; and that no specimen had then been caught in the Firth since the year 1816. He adds that the pilchard is easily distinguished from the herring, sprat, and whitebait, by the position of the dorsal fin. If either of the three latter fish be suspended by the anterior dorsal rays, the head will be observed to dip considerably; whereas, if the pilchard be thus suspended, the body will preserve an equilibrium. The writer found that the fishwomen thoroughly apprehended this last-mentioned characteristic of the pilchard as the one most obvious and unmistakeable by an observer, and were quite aware of the nature of the fish they were bringing to market as distinguished from the herring, stating, that by many people they were not so much liked as food. Many of the specimens were opened by the writer, for the purpose of ascertaining the existence of milt and roe, but not the slightest appearance of the latter could be found, the milt being, however, distinctly seen in a rudimentary state. These fish, when dressed for table, were found to be in very fine condition, although differing in flavour from the herring, and to some tastes, as the fishwomen had said, not so palatable. It was matter of regret that the pilchards were only caught in large quantity for a few days in March, although sparingly among herring through the winter; and this partial appearance in the Firth in the present season corroborates Yarrell's statements on the subject. As respects the spawning of the herring, the best authorities hitherto, although with some doubt and misgiving, have assigned the periods of March and October as the times of deposit. The writer has, during the past winter, found the herrings taken in the Firth of Forth to be either gravid with spawn and milt, or else spent fish, continuously from the month of November until the end of March, during the whole period that the fish was sought after and taken; and he sees no reason to doubt that during the whole period that the herring is found upon our shores, it is there for the purpose of depositing its spawn, which not improbably occurs the whole year round.

Mr J. M. Mitchell exhibited several specimens of the sprat or garvie herring, *Clupea sprattus*, with well developed milt and roe. These fish were taken above Queensferry about dorsal ray to extremity of tail, 10⅛th inches; length of dorsal fin, 2¾ inches, with 39 rays resting on eleven rings, three of which belong to the tail.

The trunk consists of 29 divisions or rings, and the tail of about 60 or 64; vent immediately under the twenty-seventh ray of the dorsal fin.

Form of the trunk from the gill to the vent is octangular, and from the vent downwards quadrangular, towards the extremity somewhat flattened.

I have given this description, as it differs somewhat from most of the descriptions of this fish. Jenyns and Yarrell give it rudimentary caudal rays, and Kaup six caudal rays. In this specimen I could not discover, even with the microscope, the faintest trace of a rudimentary ray, when not more than half an hour dead. Kaup says that this species has till now (1856) been found only in the south-west coast of Scotland, in Ireland, the Isle of Man, at Havre, and in Norway. He does not appear to be aware, as noticed by Dr Parnell, that prior to 1685 Sir Robert Sibbald obtained a specimen from the Firth of Forth; and within the last few years, Dr J. M'Bain and Dr J. A. Smith each got specimens. The last is now in the Natural History Museum, College, Edinburgh.

[As this fish has not been often distinguished or described, there are here added, for the sake of comparison, the notes formerly taken from the specimen examined by Dr Smith, and exhibited at the meeting of this Society, on 25th January 1860. These details were not included in the notice of the fish printed in the Proceedings, see page 139.

### *Notes of the Æquoreal Pipe Fish* (Nerophis Æquoreus), *taken at the Isle of May*. By JOHN ALEXANDER SMITH, M.D.

*Nerophis Æquoreus*, Kaup[*]; *Syngnathus æquoreus*, Yar. The Æquoreal-Pipe Fish. The general colour of the fish is brownish-yellow, approaching to olive-green on the back. Pectoral, anal, and caudal fins awanting.

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[*] Catalogue of Lophobranchiate Fish in the Collection of the British Museum, 1856, by Dr J. J. Kaup.

was in beautiful plumage. Mr Charles Muirhead, Queen Street, informed Dr Smith that it was shot near Bathgate on the 17th of March. The bird is rare, or at least seldom seen in the neighbourhood; and this specimen is also interesting from the very early season of the year when it was killed. Montagu mentions having seen it in Devonshire "as early as the 14th of March." It is generally considered to be migratory,—one of our regular summer visitors. Its allied species, the Corn Crake, does not visit us until the beginning of May.

A vote of thanks was given to the OFFICE-BEARERS, and the Society adjourned to the beginning of next winter session.

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## ERRATA.

Page 228, top line, *for* 1861, *read* 1860.
— 297, line 17, *for* polychlora, *read* polychloros.
— 297, line 18, *for* borearea, *read* borearia.
— 442, line 27, *for* M'Bean, *read* M'Bain.
— 442, line 30, *for* Apenhais, *read* Aporrhais.
— 442, line 34, *for* Echinus, *read* Echinoderm.

# PROCEEDINGS

OF THE

# ROYAL PHYSICAL SOCIETY.

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## NINETY-FIRST SESSION, 1861-62.

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*Wednesday, November* 27, 1861.—T. STRETHILL WRIGHT, M D., President, in the Chair.

William Stevenson, Esq., Accountant, Dunse, was balloted for, and elected a non-resident member of the Society.

The following donations to the Library were laid on the table, and thanks awarded to the donors:—

1. (1.) Transactions of the Royal Society of Edinburgh. 4to. Vol. xxii. Part 2., 1859-60. (2.) Appendix to the Makerstoun Magnetical and Meteorological Observations. 4to. (3.) Proceedings of the Royal Society of Edinburgh. 8vo. Vol. iv., No. 50.—From the Society. 2. Proceedings of the Royal Society of London, Vol. xi., Nos. 43-45.—From the Society. 3. Observations on Temperature in connection with Vegetation. By J. H. Balfour, A.M., M.D. 8vo. 1861.—From the Author. 4. Proceedings of the Zoological Society of London. 8vo. 1860, Part 3, June to December; and 1861, Part 1, January to March. —From the Society. 5. Canadian Journal, Toronto, No. 32, March; No. 34, July; and No. 35, September 1861.—From the Canadian Institute, Toronto. 6. On Canadian Caverns. By George D. Gibb, M.D.—From the Author. 7. The Canadian Naturalist and Geologist, and Proceedings of the Natural History Society of Montreal, Vol. vi., Nos. 1-5.—From the Society.

Dr WRIGHT then delivered the Opening Address:—

GENTLEMEN,—I have now to greet you on the commencement of the ninety-first session of the Royal Physical Society, which opens full of promise. Not only can we look back with satisfaction on the many valuable papers which have of late years been read at this table, and which, treasured up in our published proceedings, and disseminated through the scientific societies of this and other countries, are assisting to preserve for Edinburgh that high position which she has attained in science; but the billet of this evening shows that, in the ensuing session, we have much to look forward to, both from our young soldiers, whose spurs are yet a-winning, and from well-tried veterans, whose names for many a year have been "familiar as household words" to the lips and pens of all those whom Natural History has taken for her own. Moreover, a highly respectable balance in the bank, and the continued influx of entrance-fees from new members, render us quite easy as to that commodity without which the highest literary and scientific attainments present but a pitiable appearance—so very easy, that a large number of our members, nearly all of us, have neglected for some years to pay our annual contributions. The Council have, however, considered it unadvisable that the property of the Society should any longer be carried about in the pockets of its members, and have directed that the arrears shall be collected, so that our available funds this year will be considerably increased. Since our last meeting, the Society has been deprived of the services of several useful and valuable members. One of them—Professor Shank More—has been removed by the hand of death. I need not in this place recount the history and attainments of one so well known as Professor More. The increasing infirmities of age had for some time prevented his taking any part in [redacted] must hope that we may still be favoured by his assistance, although he may not often be able to come amongst us. The work of the Society for the last session has been well divided amongst the members. On the *Vertebrata* the papers consist of those of Dr Cleland on the articular processes of the Atlas and Axis; Dr M'Bain on the anatomical distinctions between the skull of the *Manatus senegalensis* and a *Manatus* from the Bay of Honduras; Mr Edwards on inflammation in fishes, in which he has determined that those animals are quite indifferent to the infliction of wounds; Mr Peach, of Wick, on the Argentine, Anchovy, and other fishes, and on the termination of the vertebrate column in the tails of the Salmon tribe; Mr J. M. Mitchell and Mr G. Logan on the natural history and fisheries of the Herring and the Sprat; Mr W. S. Young on the Œquorial pipefish and its specific distinctions. In *Entomology*, Mr R. T. Logan's paper—on the occurrence of *Vanessa polychlora* and *Cheimatobia borearea* in Edinburghshire. On the *Cœlentrata* two notices by Dr Strethill Wright—on reproduction in *Chrysaora*, and on *Atractylis coccinea.* On the *Protozoa* we have Dr M'Bain's notices of sponges from Shetland and elsewhere, together with his very valuable and interesting exposition of Bowerbank's recent discoveries and classification, and Dr Strethill Wright's papers on reproduction in Ophryodendron, on Dendrophrya and Lecythia, and on Rhizopod structure, and his discovery of ova and spermatozoa in that class of animals. In *Geology* and *Mineralogy* several very important papers have been read, including Mr R. H. Traquair's on the Trilobites of the Carboniferous Limestones of Fifeshire, accompanied by beautiful delineations of species. Mr Andrew Taylor on the exposure of the Liberton Old Red Sandstone conglomerate bed at Newington; and Mr John S. Livingston on the state of our knowledge respecting metamorphism in the mineral kingdom, in which he has given a most interesting account of the production of minerals by artificial means. To all these gentlemen I beg, in the name of the Society, to give cordial thanks for their assistance in the furtherance of its objects. To Dr J. A. Smith, our Secretary, special thanks must be offered for the constant supply of objects of interest which he has every evening placed upon our table, and his valuable observations thereon; and to Mr G. Logan, the Convener of the Dredging Committee, for his Report.

Such has been the result of the past session. Good steady work has been done, and patiently recorded. We are men of work, not of talk. We have given forth no voice on the grand hypothetical questions which are now troubling the commonwealth of Natural Science. We have been singularly apathetic as to whether or no the stock of our first parent struggled upwards through innumerable adversities from a monad to a man. I fear, indeed, that we are prejudiced people, and would rather leave the question as we found it settled many a year ago at our mother's side. We have given no opinion as to whether the king of the Gorillas died gloriously advancing on his terror-stricken foe, and beating a far-resounding tattoo on his tympanic chest, or whether he was brought to the ground by a rifle-shot in his cerebellum while ignominiously bolting up a tree. But we have been jotting down hard little facts,—rough diamonds, which by-and-bye we may see taken up and ground, and polished, and set by other hands,—central points of crystallization, which we may find dotting the pages of great standard volumes, and glimmering from amid the small type of their foot-notes and indices. *Sic itur ad astra.* These small facts are the foundations of adamant on which

Arabian fable! How little did he, who first noticed the attractive property of the loadstone, imagine that to him was revealed a power which would one day guide the commerce and navies of the world over the pathless seas,—which would veer off the floating city, laden with the hopes of a thousand human hearts, and careering over the dark waves with the speed of the wind, from the treacherous iceberg and the crashing floe,*—which would link together in the closest bonds all the kingdoms of the earth,—which could correlatively transmute all the forces of nature—and which may one day render the great sea itself one mighty storehouse of fuel and power for the benefit of mankind!† How little did he, who first linked together an atom of hydrogen with two of carbon and three of chlorine, dream that then was revealed to mankind the beneficent Elixir which would cause that dread and ancient travail of the woman to cease, —which would change the despairing moan and the agonising terror of the operating table for a calm and dreamless slumber—and which shall render the fame of Dumas and Simpson undying, until the stream of time shall flow for suffering humanity no more!

So it may happen that some unambitious observation made here may throw unexpected light on the Geology of our country,—may endow vast districts with mineral wealth undreamt of,—may modify all our received views of cell-life —and may put down a hard little point, on which may arise the Physiology and Pathology of the future. Let us therefore go on as we have done, not urged by the desire of fame or notoriety, but constrained by the love of knowledge and truth.

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* Mr Alexander Bryson has lately made a beautiful application of Melloni's pile to the detection of the position of icebergs at sea—the needle of the instrument directing the steersman to avoid them.

† The application of the magneto-electric machine to the conversion of mechanical power into electricity, chemical action, &c., is at present but in its infancy. Magneto-electricity has, it is true, been largely rendered available in electro-metallurgy, in telegraphy, and for obtaining lighthouse illumination. But the day will surely come when the vast water-power of the world will be employed, through the intervention of the magnet, in effecting enormous chemical operations; amongst which will be the resolution of water into its elements, and their application to those purposes for which coal is now employed.

Our Society has still another function. It plays its part as an exponent, through its reports in the daily press, of the progress of Natural Science—a knowledge of which cannot fail sooner or later to give a higher tone to the literature and cast of thought in our country. It is painful to notice how the writings of many of the most talented and accepted authors of our day are entirely uninfluenced by the sublime realities of Creation,—realities which excel in their grandeur the most transcendent dreams of the imagination. The poet who prates of "the pale cold moon," and the "throbbing and pulsing stars," as the bashful witnesses of some illicit love affair, entertains or feigns an infinitely more degraded conception of his relation to the Universe in which he is placed, than the child who lisps at evening,—

"Twinkle, twinkle little star,
How I wonder what you are."

For that wonder, which accompanies the little one in this his first step towards the attainment of truth, will go hand in hand with him, until in after years he may have sounded all the known depths of the Cosmos. By-and-bye he looks upwards to the Firmament in the night season with the astronomer, and sees, in the luminous pathway which is extended on high, an awful system of suns—a mist of suns—of whose vast size and distance from each other, numbers fail to impart to the human mind any conception. Each shining particle of that dense sun-cloud, he is told, wonderplanets around their Suns in slowly rocking orbits,—of Suns linked in circling round with their fellow Suns, blue, and orange, and green, and crimson,—of Universe linked with Universe,—of immeasurable rings and clusters, and complicated spiral whirlpools, lustrous with countless myriads of Suns. But who shall recount to him the unimaginable mysteries of being,—of life, and mind, and soul, called forth by the voice of the Almighty, around each radiant centre!—Who shall report "their holy triumphs out of evil wrung!" —Who shall tell of the great Hosanna, arising throughout these illimitable creations, for ever before the all-pervading mercy-seat of God!

Again;—this green duck-pond presents no inviting or miraculous appearance. But the philosopher, still a wondering child, places a drop of its slime under the highest power of the microscope, and a world of beautiful fish-like creatures starts into view,—the green Euglenas. He notes the accurate wave-lines of their taper forms,—the long, lashing trunks by which they scull themselves along,—the brilliant crimson eye-speck, which hints of a sense perhaps unknown to man,—the wonderful provision made for their multiplication and preservation,—how a single Euglena, by incessant self-division, becomes an infinite host,—how, when the summer sun is drying up the puddle which is its Universe, it seals up itself in a cell of horn, like the Indian Fakir, and lies hard and dry in the mud, or floats a speck of dust upon the breeze, until a welcome shower restores it to liberty and life, when it creeps out of its cell again, not one, but a swarm of little Euglenas.*

The filthy scum that coats the common sewer, and hangs in long floating fringes from every stick and stone in our Water of Leith, becomes in like manner transformed into vast assemblages of the most wonderful and beautiful of all animalcules,—into forests of Carchesium, each animal of which is as a many-branched tree of glass,—each branch instinct with life, slowly extending, or quickly contracting itself in convoluted spirals,—each twig crowned with its vase-shaped zooid, wreathed with a whirling glory of never-resting cilia; *there* is the contractile heart; *there* the circling round of moving fluids that ceases not but with life.

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* There can be little doubt that the Euglenas are plants, endowed with motion and sensation for light. I have plentifully obtained oxygen gas by exposing these organisms to strong sunlight.

Within the branching galleries of these sponges, uprooted and driven landward by the hissing tide, lurk tiny Polythalms, strange and beautiful forms, the microtypes of things that lived in the cloudy dawn of earliest time. Here the old Baculoid and Hamoid and Nautiloid models appear again in the beaded wands and spirals of these many-chambered shells—each a city whose indwellers are but little patches of slime. No bright-eyed Nautilus puts forth its clasping arms from these richly-sculptured habitations; they are built up by a shapeless and unorganised glair—a living glair, which streams as a filmy network from all their thousand openings, and spreads afar its glutinous meshes, whose touch is death—a formless mystery, beneath whose plastic force lie moulding the solid mountain chains and continents of a future world.*

Amidst the crannies and furrows of these stones and broken shells, dredged from the deep, the wildest stories of Arabian romance are imaged forth in facts of every-day experience. From the delicate and fluted flasks of these Lagenæ issue beings no less wonderful than those cloudlike Marids whom, sealed in bottles of brass, Solomon plunged beneath the waters of El Karker;† while these silvery Ephelotas, seated on their tall and glassy watch-towers, stretch forth arms deadly as those of Dahish, an Efreet rious life-histories, of deeper import than the astronomer's record of all those infinitudes of wandering fire. Each day the sea, slowly creeping back from its weedy shores, calmly reveals unknown and inexhaustible treasures, or, driven into fury by the storm, casts at our feet rarer gems from its deepest storehouses. Each night its waves glitter with sparks of living light, the handiwork of a Providence which never slumbers nor sleeps. Night after night, o'er all the tide-lashed margins of the deep, the shining kingdoms of the great Polyp-world blaze before the Lord. All the day long stretch they forth their arms motionless waiting their meat from His hand. These, seen but by the seeker, wreathing the worn rocks with garlands of living flowers; —these, towering up from the sombre depths of the Norwegian fiords, lofty as mighty forest trees;—these, clear and tiny as drops of dew, bounding along the surface of the summer seas;—these, slow wheeling like stately argosies, trailing their fringed streamers in graceful spirals many a foot behind;—these, God's workers from the beginning, raising against the Pacific surges vast barriers, before which all the proud erections of man dwindle into insignificance and which shall endure when the boasted monuments of his religion and his fame shall have crumbled into dust.

Again:—our philosopher, still a wondering child, can look back with the geologist, and see " as in a glass darkly," the earth primeval and void, brooded over by the creative spirit of the Almighty. He can view the traces of those mighty elemental wars—those slow millions of years, that lifted the land from the deep;—those slow millions of years, when the early foliage was creeping over its denuded surface, and the unfolding beauties of the radiata and the mollusc received the approving fiat of Him for whose pleasure they are and were created;—those slow millions of years, when the brood of the dragon reigned—when gigantic Saurians trailed themselves through the plashy marshes, darted fish-like through the waters, or, poised on bat-like wings, filled the dank air with bellowing croaks and shrill whistles; *there*, where ages upon ages afterwards, the wolf howled amidst the dense oak forests of Britain, and snuffed the human holocausts

[illegible]

[illegible] as the [illegible] of Sir [illegible] the

[illegible]

On the motion of Mr Alexander Bryson, seconded by Dr M'Bain, a cordial vote of thanks was unanimously given to Dr T. S. Wright for his valuable services as President of the Society, and for his learned and beautiful opening address.

Mr Bryson then called the attention of the Society to the value of recording facts, however trivial they might seem, and reminded the fellows that the discovery made by their distinguished member, Mr Peach, and communicated to this Society, of *goniatites* and other shells, near Durness, had induced Sir Roderick Murchison to remodel his strategraphical arrangement of the rocks of Scotland.

Dr M'Bain said that he was present when the first fossils from Durness were shown to the Royal Physical Society, and that the late Hugh Miller then considered them to belong to the Old Red Sandstone. At the same time, Mr Miller observed that other fossils, in a more perfect state of preservation, would probably be found in the same locality, that would enable geologists to decide what formation they belonged to. Dr M'Bain also remarked that simple facts might lead to important results in applied science as well as in the higher generalisations; and stated an instance within his own knowledge, to which the President had incidentally referred, of the application of Melloni's thermo-electric thermometer, by their distinguished member, Mr A. Bryson, to the detection of icebergs at sea, which might ultimately be the means of saving an incalculable amount of life and property.

Dr Wright then proceeded with a Report on the anatomy of the *Hydroidæ*.

by cannon—booming for a great and peaceful victory. A true and noble man hath laid aside his titles, and honours, and power; and hath passed from the uncertain and turbulent shadows of this world, to the serene light of the eternal day. Gentle, and wise, and good,—earnest in the work of the present,—he was of those who, standing on the mountain tops, gaze wistfully on the brightening dawn of the future. "*Nobody,*" saith he, who, being dead yet solemnly speaketh—"*Nobody who has paid any attention to the peculiar features of our present era, will doubt for a moment, that we are living at a period of most wonderful transition, which tends rapidly to accomplish that great end to which, indeed, all history points*—THE REALISATION OF THE UNITY OF MANKIND." (Speech of the Prince-Consort at the Lord Mayor's Banquet, 1850.)

**The following Communications were then read :—**

### I. *On the Anatomy of* Sacculina *with a description of the Species.* By JOHN ANDERSON, M.D. Plate XIII.

Three years ago I drew the attention of this Society to the fact of the frequent occurrence of *Sacculina* and *Peltogaster* on some of the Crustacea of the Firth of Forth. For some years past the subject of the affinities of these parasites has been occupying the minds of many foreign observers; and the following observations, therefore, are brought before the Society in the hope that they may tend to throw some light upon this difficult question. In the present paper I have purposely abstained, as far as possible, from dogmatising regarding their systematic position, but elsewhere I have referred them to the Cirripedes.* I may mention that the relative position of the investing sacs, the character of the ovaries and the ovigerous lamellæ, and the apparent hermaphrodite nature of the adult animal, when viewed in connection with the larval form, appear to me clearly to indicate their Cirripedial nature. Accordingly, in my graduation thesis, I created a new order (Sacculinacea) for their reception.†

Among recent observers, Leuckart drew the attention of naturalists to Thompson's systematic description of *Sacculina*, and proposed the adoption of his generic term. "If we restore," he says, "the name *Sacculina* either for *Pelto-*

***Peltogaster carcini***, Rathke, and ***Pachybdella Rathkei***, Diesing.

### *The Larva.* Pl. XIII. fig. 1.

The larva, in the first stage, is oval, and presents no marks of segmentation. Placed near the centre of the anterior margin of the body is a yellow speck—the eye (*a*). The ocellus is placed nearly in the centre of a dark-coloured ring (*b*). Krohn, who has observed a structure similar to this in the larva of a Balanide, regards it as the œsophageal ring. The lateral margins of the body, on either side of the ocellus, are prolonged into two horns (*c*); and in this respect the young resembles the Cirripedian larva in its first stage. It is provided with three pairs of natatory legs: the first pair (*d*) are situated immediately posterior to the horns of the carapace; they are uniramous, are provided at their extremities with bristles, and appear to be composed of two joints; the second and third pairs (*d′ d″*) are larger than the first, and are both biramous. The rami are furnished with bristles. The under surface of the body is prolonged into two spines (*e e*), which project beyond the posterior margin of the carapace. Besides these terminal spines, I have observed through the transparent body, two other structures (*f f*), which resemble very much the middle pair of spines described by Darwin as occurring on the larva of *Chthamalus stellatus*. The greater portion of the body is occupied by an oval mass of nearly spherical globules (*g*). The various transformations of the larva remain yet to be determined.

### *The Adult Animal.* Pl. XIII. figs. 10, 11, 12, 15.

According to the present state of our knowledge, this parasite seems to be peculiar to the Decapod Crustacea. All the specimens I have obtained have been attached over the terminal portion of the intestinal canal (figs. 10 & 11 *b′*) of the crabs on which they were parasitic, the females of which they appear to infest more than the males. This latter circumstance seems to be owing to the large size of the purse of the female, as compared with that of the male crab, affording them a better protection and means of support.

*The external sac* (figs. 2, 4 *a*).—The external skin is a face of its ovigerous sac. The ova (fig. 6) are enclosed in the sac, and are arranged in a racemose manner, enveloped in a very delicate membrane.

*The internal ovaries* (figs. 2, 3, & 3′, *h*) are situated posteriorly to the peduncle. They constitute an oval, flattened, pulpy mass, dividing the cavity of the parasite into two compartments; they are attached by the centre of their posterior margin to the left wall of the ovario-branchial orifice; and also, as previously mentioned, by the septum which runs along the left side of the sac, they are connected to the corium (fig. 2 *g*). In the many specimens examined, I have always found a small tubercle (figs. 2 & 3 *o*), with a minute and apparently horny speck on its summit, placed on both surfaces (figs. 3 & 3′, *o*) of the body of the ovaries lying opposite to one another, a little to the left of the centre of its posterior margin. On removing the little speck of horny matter, a depression is seen in the centre of the tubercle, apparently communicating with the substance of the ovaries. May not these structures be the orifices of the oviducts, closed by a temporary secretion of horny matter till the brood of ova in the ovigerous sac has attained its full development? This view of the nature of these tubercles has suggested itself to me from the difficulty of accounting for the passage of the ova into the ovigerous sac. The fact that the ova found on the external surface of the ovaries are always more fully developed than those further removed from the in the generative economy of the animal. This opinion seems to be strengthened by the fact that, on one occasion, when examining under the microscope a portion of the ovaries in the immediate neighbourhood of the vesicles, I detected among their convolutions a tube identical in appearance with the structure of their ducts. As yet, I have found it impossible, from the soft nature of the tissues of these parasites, to trace the ducts to their final termination; but, from the appearance of the tube above described, it seems to me very probable that they terminate in the ovaries. The walls of the vesicles are simply granular. A peculiarly formed body (figs. 7 and 8 *c*) is placed in the interior of each of the vesicles, immediately over the opening of their ducts. The portion of this body situated immediately over the ducts (*b*) is of a brown colour, and apparently of a horny consistence, and is terminated by three processes. The whole structure (fig. 9) is extruded when pressure is applied to the vesicle. May not these vesicles represent the testes and cement-glands of these parasites?

These observations have been made from dissections of a new species, parasitic upon *Cancer pagurus*: it differs in its anatomy from *Sacculini carcini* in the form and position of the vesicles. In the former species these organs are oval, and placed immediately posterior to the peduncle, while in the latter they are elongated (fig. 16), and buried in the left anterior angle of the ovaries.

The relation of the septum to the surrounding structures, and the double nature of the ovigerous sac, hypothetical oviducts and testes, indicate a tendency to bilateral symmetry.

### Genus SACCULINA, Thompson.

*Sacculini carcino*, Thomps. Pl. XIII. figs. 10 and 12. Thompson, J. V., Entomol. Mag., vol. iii., 1836, pp. 452–456.

*Peltogaster carcini*, Rathke, Beiträge zur Fauna Norwegens, Acta Leop. xx. p. 247, tab. 12, figs. 18, 19.

*Pachybdella Rathkei*, Diesing. Syst. Helm. i. p. 435.

*Diagnosis.*—Bilobata est, maxima diametro per transversum; parasitica in *Carcino mænade.*

This species is confined to *Carcinus mænas*, and, in my own experience, is almost always found on the female crab.

It is bilobular in form, its greatest diameter being in the transverse direction. The figure given by Cavolini of the parasite he described exactly corresponds with this species. It varies greatly in size, and is undoubtedly the largest known species of these parasites. Some of my specimens are an inch in breadth. The skin, in the generality of specimens, is of a brownish-yellow colour, and is minutely corrugated.

This species has a wide geographical range. Cavolini obtained his specimens from the shores of the Mediterranean; Rathke first met with it in the Crimea, and afterwards in Norway; Schmidt found it in great abundance at Wangerooge, and he also obtained specimens on the Dalmatian coast; Steenstrup's specimens were from the Mediterranean and from the "Black Banks" in the North Sea. From the observations of Thompson, this parasite appears to be of frequent occurrence on the Irish coast. Some years ago I found this species for the first time in the Firth of Forth, but not nearly in such numbers as the following one.

*Sacculina triangularis*, n. sp., figs. 4, 11, 14.

*Diagnosis.*—Triangularis est, gregaria, raro sola; maxima diametro ab pendunculo ad posterius foramen pertinente: parasitus *Cancri paguri*.

This species is usually gregarious; sometimes as many as five individuals may be found huddled together and strugdistended with ova, and adhering to the purse of a *Cancer pagurus.*

*Sacculina inflata*, Leuckart, fig. 15 (Wiegmann's Archiv., 1859, p. 232.)

*Diagnosis.*—Dorsi et ventris superficies multum arcuata est; posteriore foramine a corporis margine aliquantum remoto: parasitica in *Hyade araneo.*

I only know of this species through the description given of it by its discoverer.

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LILLJEBORG, WILH. Nova Acta Reg. Soc. Sc. Upsal. Ann. of Nat. Hist., 3 ser. vol. vi. pp. 162–173, and pp. 260–267

### *Explanation of Plate* XIII.

Fig. 1. Larva of *Sacculina;* first stage: *a*, eye; *b*, œsophageal ring?; *c*, horns of carapace; *d*, first pair of feet; *d'*, second pair of feet; *d''*, third pair of feet; *e*, terminal spines; *f*, supposed anterior spines; *g*, central cellular mass of the body.

Fig. 2. Dissection of *S. triangularis: a*, portion of external sac reflected; *b*, peduncle; *c*, ovario-branchial orifice; *d*, horny disk; *e*, corium; *h*, internal ovaries; *i*, ovigerous lamellæ; *k*, portion of peduncle prolonged beyond the horny disk; *l*, vesicles; *o*, tubercle of anterior surface.

Fig. 3. Anterior surface of interior ovaries removed from their connections; *g*, the septum; *h*, mass of internal ovaries; *o*, tubercle (oviduct?) *e*, portion of adhering corium [these letters apply also to fig. 3']; *l*, the vesicles.

Fig. 3'. Posterior view of internal ovaries of *S. carcini.*

Fig. 4. *Sacculina triangularis;* external skin and corium reflected: *a*, external skin covered internally by the corium; *i*, ovigerous lamellæ.

Fig. 5. Ovigerous sac, showing the anterior and posterior folds which embrace the internal ovaries.

Fig. 6. Mass of ova from the ovigerous lamellæ.

Fig. 7. Greatly magnified view of one of the vesicles, drawn from a fresh specimen: *a*, the duct of the vesicle; *c*, the structure found in the interior of the vesicle; *b*, the horny substance found at the commencement of the duct.

Fig. 8. The same organ as fig. 7, drawn from a specimen preserved in alcohol: *a*, the convoluted duct; *b*, the horny process.

Fig. 9. The structure found in the interior of the vesicle, removed.

Fig. 10. *Sacculina carcini*, with no ovigerous lamellæ, nat. size: *b*, the peduncle; *b′*, intestine of crab; *c*, ovario-branchial orifice.

Fig. 11. *Sacculina triangularis*, nat. size. (Same references as in fig. 10.)

Fig. 12. *S. carcini* distended with ova.

Fig. 13. Posterior view of fig. 12; *d*, horny attachment of peduncle; *k*, prolonged portion of the same.

Fig. 14. A group of *S. triangularis.*

Fig. 15. *S. inflata* (after Leuckart).

Fig. 16. Enlarged view of the vesicles of *S. carcini.*

## II. *Observations on British Zoophytes.* 1. Hydractinia areolata, *n. sp.* 2. Atractylis arenosa, *n. sp.* (Plate XIV.) By JOSHUA ALDER, Esq. Communicated by T. STRETHILL WRIGHT, M.D.

### 1. *Hydractinia areolata*, n. sp. Plate XIV., figs. 1–4.

*Polypary* encrusting, consisting of a solid chitinous expansion, from which arise simple linear spines in irregular groups, leaving areolar spaces between them. *Polyps* lumnar, with four tufts of thread-cells surrounding the mouth.

A single specimen only of this interesting little *Hydractinia* was obtained, parasitical on a dead shell of *Natica Alderi* brought in by the fishing-boats at Cullercoats. I have since seen a dead and rather worn specimen, upon *Natica Grœnlandica*, among the Zoophytes collected in Shetland by the Rev. A. M. Norman. The species differs from *H. echinata* in its much smaller size, the simple linear form of its spines, their irregular grouping, and more especially in its bearing medusoids; these latter spring from the encrusting base. No capsule could be detected; but this might possibly arise from its great transparency. The medusoids bear a great resemblance to those of *Podocoryne carnea* (Sars), the only difference being in their having eight intermediate tubercular tentacles. In this respect they also differ from the medusoid of a Hydroid polyp described by Professor Lovén, and referred by him to *Hydractinia*, but which appears rather to belong to the genus *Podocoryne*, as the base was not horny or spinous. As far as I am aware, therefore, this is the only instance in which medusoids have been ascertained to be produced by a true *Hydractinia*.

### 2. *Atractylis arenosa*, n. sp. Pl. XIV. figs. 5–7.

*Polypary* minute, consisting of a creeping fibre, from which arise short funnel-shaped tubes, rather irregular in form, but always expanding more or less at the top, from which the polyps issue, generally covered with minute grains of sand. *Polyps* entirely retractile, with long, slender, strongly muricated tentacles, varying in number, according to age, from six to twelve.

The genus *Atractylis* has been established by Dr Strethill Wright for a group of Hydroid Zoophytes resembling *Eudendrium* in many of their characters, but differing in the conical form of the mouth of the polyp, and its retractility (partial or complete) within the tubular polypary. They are generally of small size, and seldom branched. Their reproduction is usually by medusoids; but Dr Wright, who has lately met with the present species in the Firth of Forth, has ascertained that it produces planuloid young direct from the summit of the ovarian sac. This affords another proof of the difficulty of establishing a genus from the mode of development.

I have met with this species occasionally, for some years past, on stones and the roots of *Laminariæ* at Cullercoats and Tynemouth. From its minute size, it requires to be carefully looked for.

### *Explanation of Plate* XIV.

Fig. 1. Polypary of *Hydractinia areolata* on *Natica Alderi*, natural size.
Fig. 2. *Hydractinia areolata*, highly magnified.
Fig. 3. A portion of the polypary of the same, highly magnified.
Fig. 4. Medusoid of the same, highly magnified.
Fig. 5. *Atractylis arenosa*, natural size.
Fig. 6. The same, highly magnified.
Fig. 7. A tentacle of the same, much enlarged.

## III. *On Reproduction in* Æquoria vitrina. By T. STRETHILL WRIGHT, M.D. Plate XV.

In vol. i. of Agassiz's "Natural History of the United States," the following passage occurs:—"As to the Æquoriadæ, I have no doubt that they are genuine hydroids, though I have not been able to trace with certainty the origin of the Æquoria of our coast to any true hydroid. But the structure of Æquoria in its adult Medusa state is so strictly homologous to that of all the naked-eyed Medusæ inches and a half. The number of lips of the latter was about forty, the radiating canals, each having a long ovisac, about eighty, and the marginal tentacles, by estimation, four hundred. On examining the ovaries, I found that the eggs were hatched, and the young, in the form of almost invisible planulæ, were issuing from the ovisacs. These were gently extracted with a glass syringe, an instrument so useful to those who practise the obstetric art amongst the hydroidæ, and were placed about three weeks ago in glass tanks of clean sea-water prepared for their reception. Many thousands of larvæ were placed in the tanks, and of those, about a score have been developed into Campanularian polyps; about a hundred are still progressing to that end, and the rest have disappeared. It was with no little impatience and anxiety that I saw the Planula during a fortnight fix itself to the glass, spread itself out into a short thread, secrete its scleroderm, put forth its polyp-bud—this last slowly swelling day by day, until at last it opened, and a polyp appeared, furnished with twelve alternating tentacles, joined together for about one-third of their length by a web, the polyp enclosed in a cell terminating in many acuminate segments. It is now about six years ago that I was watching, in like manner, the slow evolution of a bud from a Campanularian Zoophyte, the *Laomedea acuminata* of Alder—the Campanulina of Van Beneden—the bud opened, and a bright green medusoid issued forth, having four lips and two tentacles. The polyp form of *Æquoria vitrina* is, as far as I can determine, identical with that of *L. acuminata* in shape; but is so excessively small—quite invisible to the naked eye—that we must wait for further development before we can determine their identity. Geganbaur has proved that the Medusoid of Velella acquires a further number of canals and tentacles; and I have elsewhere recorded the successive changes which occur in the Medusoids of several species of Atractylis. It is also certain that such increase in the number of elements does occur in *Æquoria vitrina*, for the smaller specimens have always a less number than the larger. Meantime, the question as to the larval state of *Æquoria vitrina* is settled. This, the

**largest of all the naked-eyed Medusas, is the reproductive phase of one of the smallest of all the Hydroidæ.**

*Explanation of Plate* XV. *Æquoria vitrina.*

1. Planula directly after leaving the ovary.
2. Same a week old.
3. Same after having fixed itself to the glass and developed its sclerodem, —now become a polypary.
4. Polypary putting forth bud.
5. Same with young polyp.
6. Empty polyp cell.

### IV. *The following Objects of Natural History were exhibited by* EDWARD CHARLESWORTH, Esq., *York.*

A stuffed specimen of the Frilled Lizard *Chlamydosaurus Kingii*, from Port-Nelson, New Zealand, believed to be the best example yet seen of this most extraordinary reptile. It was purchased at the sale of the late Dr Mantell's Museum.

A small but extraordinary coral from the Chinese Seas, believed to be undescribed.

A series of small fossil tertiary shells from Barton, in Hampshire, illustrated by magnified figures.

A collection of small recent British Marine shells, illustrating a new mode of mounting and exhibiting very small specimens, intended to insure safety with effective display. The shells were fixed on cards with *gum tragacanth*, which can be freely brushed across the surface, and thus save much time in mounting, as it does not shine when dry, like gum arabic. The cards are then put in small boxes with glass lids.

A specimen of *Mactra Helvacea*, and other shells from the Channel Islands; several rare fossils of various kinds were also exhibited.

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*Monday*, 16*th December* 1861.—ALEXANDER BRYSON, Esq., President, in the Chair.

The Office-Bearers for the Session 1861–62 were elected as follows:—

**Merchant, Glasgow; J. Alfred Wanklyn, Esq., M.R.C.S.L., F.R.S.E., &c., Demonstrator of Chemistry in the University of Edinburgh. Captain F. W. L. Thomas, R.N., was elected a non-resident member.**

It was moved by George Logan, Esq., that on account of the deeply lamented death of H.R.H. the Prince Consort, the Society do adjourn to the fourth Wednesday of January.

The motion was unanimously agreed to; Alexander Bryson, Esq., making the following remarks from the chair:—

Gentlemen,—I cannot close the meeting of the Society without giving expression to feelings which I know animate the breast of every Briton. Never in my own remembrance has such a sensation been experienced as that which thrilled through the kingdom yesterday, when the people learned that their beloved Queen was a widow. The late Prince Consort was among the few of the great and distinguished who honoured himself by honouring our pursuits by his appreciation and knowledge of them. We must ever feel how much our country has been indebted to Prince Albert for many institutions cognate with our own, and it is to me a satisfaction, though a melancholy one, that he was enabled to do so much good work.

Mr William Turner, M.B., begged that before the Society adjourned, he might be allowed to exhibit some moist preparations he had brought in illustration of his paper, as they could not be preserved and again exhibited. Mr Turner's request was agreed to, and the following communication was laid on the table:—

### I. *Upon a Non-striped Muscle connected with the Orbital Periosteum of Man and Mammals; and Notes on the* Musculus Kerato-cricoideus.

**By William Turner, M.B. (London), F.R.S.E., Senior Demonstrator of Anatomy, University of Edinburgh.**

Whilst engaged in making a dissection, in the human subject, during the winter session of last year, of the superior maxillary, or second division of the fifth cranial nerve, my attention was attracted to a pale-reddish, soft mass, filling up the narrow chink of the spheno-maxillary fissure, and extending from the sphenoidal fissure in the sphenoid bone to the infra-orbital canal in the superior maxillary bone. It was evidently connected to the superior (ocular) aspect of the periosteum of the orbit, and it was pierced by the orbital branch of the superior maxillary nerve, from which, as well as from the ascending branches of the spheno-palatine ganglion, it appeared to receive its supply of nerves.* It completely shut off the superior maxillary nerve, with its infra-orbital continuation, from the cavity of the orbit.

Since the period of making the above observation, I have availed myself of several opportunities of examining the same region in other subjects, and have constantly observed appearances of a nature similar to those just described. The amount of the reddish mass, and the depth of its tint, varied slightly in different instances. Frequently it was so pale as scarcely to attract attention, which may perhaps be the reason why it has so long been neglected by anatomists. When carefully examined with the naked eye, or, still better, with a single lens, it was seen to exhibit a fibrous appearance. A small portion snipped off with scissors, teased out with needles, and placed on the stage of the microscope, under a quarter-inch objective, was observed to be composed of pale, flattened, band-like fibres, having a faintly granular aspect, and presenting indications of elongated nuclei at intervals. From these characters I had little doubt that the structure in question consisted of the firmed the opinion of the structure already expressed. The orbit of this animal differs from that of man in possessing much less perfect walls. As a consequence of this, the orbital membrane, or periosteum, is a structure of much importance, for it stretches across the floor of the orbit from its outer to its inner wall, extends backwards to the optic foramen, and completes the boundary of the cavity at the spot where the bony wall is wanting.

If the contents of the orbit be carefully removed, and the orbital membrane examined from above, it will be seen to be a well-defined structure, distinctly fibrous, and in many places having an almost tendinous-like aspect. Intimately connected with, and forming an essential part of it, is a thin layer of a pale reddish substance, which extends across the greater part of the floor of the orbit, passing backwards to the optic foramen and sphenoidal fissure. In close contact with this structure, especially at the posterior part of the orbit, is a well-marked vascular net-work, sufficiently injected with blood to be distinctly visible. This vascular plexus constitutes a small rete mirabile, connected with the ophthalmic artery. By removing a small portion of the reddish mass, teasing it out with needles under water, and examining it with a quarter-inch objective, it may be seen to be composed for the most part of flat, pale, non-striped fibres, collected together in bundles, having a faintly granular aspect and exhibiting decided indications of nuclei in their interior. These bundles of flat fibres are mingled with ordinary fibrous tissue, both white and yellow, the latter becoming more distinct after the addition of acetic acid. The pale, non-striped fibres have all the characters of the involuntary muscular fibre. Being desirous, however, of ascertaining if these fibres could be resolved into their constituent fibre-cells, I adopted the plan which has been recommended by *Reichert*, and macerated a portion of the orbital membrane for forty-eight hours in dilute hydrochloric acid. I then found that, by the aid of a very slight dissection, the fibres readily resolved themselves into the elongated fusiform cells of which they were composed. In no tissue which I have ever examined, consisting of the non-striped muscle, have I succeeded in obtaining more beautiful and more perfect specimens of the contractile fibre-cell than in this muscle of the orbital membrane. The fusiform shape of the cells, their size, and the elongated rod-like nucleus in the centre of each cell, gave to the texture a most characteristic appearance. I may also mention, that when the orbital muscle in the sheep was examined without the addition of any re-agent, besides distilled water, a number of elongated rod-like nuclei were always met with, lying free in the water surrounding the preparation, which had evidently been loosened and detached during the dissection with the needles. These nuclei corresponded in their characters to those met with in the interior of the fibre-cells. The characters which I have now enumerated render the muscular nature of the reddish texture connected with the orbital membrane sufficiently clear.*

On referring to the authorities who have written on the structure of the orbital membrane, I find that the following opinions have been expressed concerning it:—

Bendz,† in a paper "On the Orbital Membrane in the Domestic Mammals," describes it as distinctly fibrous, but possessing a considerable quantity of a yellowish tissue, which he considers to be elastic, interpolated with it. He regards the opinion, which had been previously advanced by Gurlt, that the tissue was muscular, to be erroneous.‡ Stannius states that in those animals in which the bony wall of the orbit is fibrous membrane which completes the cavity of the orbit as entirely composed of white inextensile fibres. Gurlt* considers it to be a strong fibrous membrane, with yellow elastic fibres interpolated. H. Müller,† in a very brief communication, states that he has found flat muscular fibres in the inferior orbital fissure in man, and corresponding structures connected to the membrana orbitalis of mammalia.

It was supposed by those, who held that the membrana orbitalis was a highly elastic and not a muscular structure, that it was through its elastic recoil that the eye-ball was reprotruded in those animals which retracted the ball, through the contraction of a retractor muscle. H. Müller, again, who speaks more positively than any who have preceded him, not only of the existence of a muscle, but also of the kind of fibre of which it is composed, considers that it antagonises those muscles which retract the eye-ball into the socket, and that thus, the reprotrusion of the globe is produced, not by a mere elastic recoil but by a muscular contraction.

If this hypothesis be correct, an arrangement exists in this locality which is certainly to be regarded as an unusual one,—viz., an involuntary muscle acting as a direct antagonist to a voluntary muscle. Whether the hypothesis be correct, or not, I am disposed to consider that the muscle has some especial relation to the vascular arrangements in the orbit. Its extension backwards to the foramina through which the orbital vessels proceed, and with which it is in immediate relation, and the very abundant vascular network found in connection with it, point, I think, to some special relation between the muscle and the vessels, a relation which is not at all inconsistent with what is known of the function of non-striped muscle in other localities.

*Note.*—Since the above paper was in type, my attention has been directed, by Professor Huxley, to a communication by H. Müller, dated Dec. 15th, 1860, entitled "On the Influence of the Sympathetic upon some Muscles, and on the extensive Distribution of Unstriped Muscles in the Skin in the Mammalia."*

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* Handbuch der Vergleich, Anat. der Haus. Säugethiere, 1860, p. 733.

† Siebold and Kölliker's Zeitschrift, 1858, p. 541.

As this paper throws some additional light upon the probable action of the unstriped muscle, I append a short abstract of it:—

H. Müller, after referring to the many puzzling questions which have arisen respecting the function of the sympathetic nerve, and its relations to the muscles supplied by it, proceeds to ask two questions:—

1st, Whether and which unstriped muscles are supplied by other nerves than the sympathetic?

2d, Whether and which transversely-striped muscles are under the influence of the sympathetic?

In answer to the first, the action of the oculo-motor nerve upon the unstriped fibres of the iris cannot be doubted; the vagus also acts upon unstriped muscles, and the experiments of Schiff have shown that the greater part of the vascular nerves are not connected with the sympathetic.

The second question may be most effectively answered by considering the effect produced upon the eye-ball by division or irritation of the cervical sympathetic. Müller, for this purpose, refers to the experiments of Bernard, R. Wagner, and Brown-Sequard; the general tendency of which is to show, that division of the cervical sympathetic produces narrowing of the palpebral fissure, retraction of the bulb, projection of the nictitating membrane and narrowing of the anterior nares and the mouth. Irritation of the nerve by section of the nerve, was produced by the active contraction of the retractor and recti, and that its reprojection by subsequent irritation was a reposition. Schiff regarded the projection of the bulb as due to the action of the obliqui: the movements of the lids he considered to be passive, and due to those of the bulb.

Remak, on the other hand, believed that the narrowing of the palpebral fissure was due to a relaxation of the levator palpebræ superioris, accompanied by a spasmodic contraction of the orbicularis. Moreover, he conceived that the sympathetic acted upon the voluntary muscles of the lids about the eye.

Müller considers that it is now no longer necessary to discuss the various probabilities respecting the influence of the sympathetic upon the voluntary muscles of the eye, as a complete series of unstriped muscles have now been observed, which will serve as a foundation for explaining the movements in question.

These muscles consist of three divisions:—

*1st,* In the orbital cavity of mammals, a membrane (membrana orbitalis), consisting of unstriped muscles with elastic tendons, exists, which, by irritation of the cervical sympathetic, projects the contents of the orbit, especially the bulb, forwards. Retraction is produced by the transversely-striped retractor. In man, the orbital muscle is much reduced in size, and the retractor is wanting, so that a distinct projection of the bulb does not follow irritation of the sympathetic, as Wagner and H. Müller himself have observed.

*2d,* The projection of the nictitating membrane in mammals is mostly due to the retractor bulbi under the influence of the N. abducens. Its withdrawal depends on some unstriped muscles which are under the influence of the sympathetic. In hares, however, the withdrawal is due to a transversely striped muscle, which is not supplied by the sympathetic but by the oculo-motorius. In man, the lid and its muscles are rudimentary.

*3d,* The upper and lower lid possess in man, and in very many mammals, unstriped muscles, which have the power of drawing them back. They are more feeble in the upper than the lower lid, so that by irritation of the sympathetic the latter is drawn back in a more marked manner than the former. Narrowing of the palpebral fissure, after section of the cervical sympathetic, depends upon relaxation of these muscles. Yet recession of the eye-ball may depend upon relaxation of the orbital muscle. Müller, then, concludes that the movements occasioned by experimenting on the cervical sympathetic are not such as to entitle us to infer an influence of that nerve upon voluntary striped muscles. He also considers that the movements about the nose and mouth, said by Bernard to be produced by section of the sympathetic, if they do take place, are owing to the presence of unstriped cutaneous muscles.

Müller next inquires into the existence of unstriped muscles in the skin of the ear. He has occasionally found, on galvanizing the cervical sympathetic in cats, that a movement of the hairs growing upon the skin at the entrance of the concha has taken place. This experiment has, however, frequently failed both in cats and other animals. A careful examination of the skin of the part did not give any indications of unstriped muscles, but very distinct muscles were seen connected to the hair follicles. He considers these experiments of interest, as they appear to indicate whence the muscles of the hair follicles receive their nerves. Owing to the movement of the hairs being limited to a very small locality, during the irritation of the sympathetic, one and outwards to be attached to the posterior margin of the inferior horn of the thyroid cartilage. He stated that the muscle was not found in every larynx, and that when present it existed only on one side.

In my remarks, I supplemented the description of Merkel with some additional particulars, more especially pointing out, that, although, as a rule, the muscle only occurred on one side, right or left, as the case might be, yet that a double muscle might exist. I figured an example of such a bilateral muscle, which at that time was the only one I had seen. Since then I have met with two additional cases in which a double kerato-cricoid muscle was present. One of these was especially note-worthy, for the muscle, on both sides, was more largely developed than in any previous example that had fallen under my notice. The great size of the kerato-cricoid muscle was combined with a general laryngeal muscularity. The occurrence of three examples of a double kerato-cricoid muscle, during the last two years, within my own experience, shows that the bilateral arrangements is not so unusual as was in the first instance supposed.*

*Wednesday, 22d January* 1862.—JAMES M'BAIN, M.D., R.N., President, in the Chair.

The following gentlemen were elected Members of the Society:—

Edward Hargitt, Esq., an Ordinary Member; and the Rev. William Cæsar, Minister of the parish of Tranent, and Daniel Manson Logan, Esq., Seafield Lodge, Leith, as non-resident Members.

The following Donations to the Library were laid on the table, and thanks voted to the donors:—

1. Report of the United States Commissioner of Patents, 1859. Mechanics, Vols. I. and II.—From United States Patent Office. 2. (1.) Annual Report of the Board of Regents of the Smithsonian Institution for the year 1859. Washington, 1860. (2.) Smithsonian Contributions to Knowledge:—Astronomical Observations in the Arctic Seas, by Elisha Kent Kane, M.D., U.S.N., Washington, May 1860; Tidal Observations in the Arctic Seas, by Elisha Kent Kane, M.D., October 1860.—From the Smithsonian Institution, U.S.A. 3. (1.) Notice of the Indians seen by the Exploring Expedition under the Com-

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* Since the above was written, a specimen of a symmetrical kerato-cricoid has been sent me by Mr H. P. Mallam, who found it in a subject in the dissecting-room of Charing-Cross Hospital.

**mand of Captain Palliser, by James Hector, M.D., and W. S. Vaux, M.A. (2.) On the Geology of the Country between Lake Superior and the Pacific Ocean, visited by the Government Exploring Expedition under the Command of Captain Palliser (1857–60), by James Hector, M.D. (3.) On the Physical Features of the Central Part of British North America, and on its Capabilities for Settlement, 1861, by James Hector, M.D., F.G.S., &c. From James Hector, M.D.**

The Address of Condolence to her Majesty on the death of H.R.H. the Prince Consort, which had been agreed upon by the Council, was submitted to the meeting by Alexander Bryson, Esq.:—

UNTO THE QUEEN'S MOST EXCELLENT MAJESTY.

*May it please your Majesty,*

We your Majesty's loyal and dutiful subjects, the Presidents, Council, and Fellows of the Royal Physical Society of Edinburgh, humbly desire to convey to your Majesty the expression of our deepest sympathy and condolence for the irreparable loss sustained by your Majesty and the Nation, in the lamented death of your Illustrious Consort His Royal Highness Prince Albert.

We beg to assure your Majesty, that we feel the loss of your Royal Consort the more deeply, as he was the enlightened Patron and earnest Student of those Sciences which we are incorporated to advance.

May the Almighty God whose works we meet to study, and whose wisdom we adore, give to your Majesty and your bereaved Family that consolation and comfort which ever

The following Communications were then read :—

1. *Notes on the Habits of the Beaver.* By an Eye-witness, James M‘Kenzie, Esq., an Officer in the Hudson's Bay Company Service. Communicated by Andrew Murray, Esq.

The Beaver is found over a wide extent of country on the American continent, extending east and west from the Atlantic to the Pacific, and probably from Lat. 48° to 54° north ; but on the slopes of the Rocky Mountains, where the climate is comparatively mild, he is met with much further north and south. My object, however, is not so much to define his geographical limits, as to make a few notes on his habits. Beavers build occasionally on the shores of lakes, but prefer the banks of rivers and streams. They go generally in pairs ; and having selected a convenient site near the banks of the river, the two clear a circular piece of ground, generally 6 feet in diameter, carefully removing everything on the surface. This done, they carry in their *arms*, walking on the hind feet, 5 to 10 lbs. of strong clay from the river, and deposit it to a width of 2 feet all round the circle, thus making the diameter 4 feet ; then collecting long grass or branches of willow, they mix up the whole well together, so as to form a good foundation. In this way they build the walls to a height of about 10 feet, gradually narrowing ; and the whole has a rounded form, somewhat like an oven. Unless they had some means of plastering or smoothing down the mud walls, the rain would certainly wear them away in a short time ; and although it is supposed that the beaver never uses his tail as a trowel, I have it from the authority of eye-witnesses that he does so—in fact, Nature has furnished the animal with the tool ready made to his hand. After he has laid the foundation, and, indeed, in process of laying it, before the clay gets dry, he uses the trowel ; and when the wall is raised to a certain height, he goes round the circle, carefully plastering every load he carries from the river and lays on his house. The lodge has neither doors nor windows, and the finishing hand is not put to it till he is far advanced with his bridge, or perhaps until he has completed it. Before the house can be completed, a subterranean passage is excavated from its centre to the dam or pond, and this at a depth varying from 2 to 6 feet, depending on the difference of level between the river and house. He then strews his floor with thin strips of willow tree, cut by him in the form of carpenter's shavings, for his winter's bed. The construction of the bridge shows even more ingenuity than the construction of the house, and is of various lengths, depending on the size of the stream. When only a few feet wide, the wall goes straight from bank to bank at right angles to the current ; when larger, or about 40 feet wide, it is formed of a single curve ; but when the river to be bridged is from 100 to 120 feet wide, the wall is formed into a series of curves, or undulations as it were. He understands pretty well the properties of straight and curved lines in his engineering works, and knows the mode best suited to the circumstances in which he is placed. If his domicile is situated on a wide stream, he adopts that mode of construction which is best adapted to withstand the pressure of a great body of water and ice on the opening of the navigation in the spring. The wall is about 12 feet high and 9 feet wide at bottom, but on the side exposed to the current it slopes with the stream, forming, perhaps, an angle of about 40°. At any rate, while the wall is about 9 feet wide at bottom, it is only 1 foot wide at top. He selects for the foundation pieces or logs of timber which are water-soaked ; but if he cannot find enough of these, any wood, either green or dry, will do, covering them with large stones, to prevent their rising to the surface. But logs thus placed on one another across a stream could not be so well fitted together as to prevent the passage of the water between them. To meet this difficulty, he plasters the side of the wall exposed to the current with a coating of clay some 2 or 3 inches in thickness; and this clay, as he has to travel through the water with it, he carries not in his arms, as in the construction of the house, but on his *head*, supported by his arms. There is no doubt that the side of the wall exposed to the current is thus clayed, although I cannot well understand how it could withstand the action of the water for any length of time. If he bridged the stream in this way and clayed his bridge, it is clear that he would have always a large quantity of water flowing over the top, which would impede his operations; and, to obviate this difficulty, he leaves an opening at either end for the passage of the water, to be shut up afterwards. Having finished the wall, the next thing to be done is to collect his winter's supply of food. This consists of the bark of the ash, the bark and leaves of a certain kind of poplar, the bark and leaves of some kind of willows, and the fruit of the alder. A large poplar tree of about a foot in diameter, two beavers can cut down in half an hour's time. It is afterwards cut into lengths of about 5 feet; and when he has got enough, he makes a road to the stream from 3 to 6 feet wide, by cutting down trees or shrubs which may be in his way. If the road be inclined towards the stream, he rolls the wood down before him; but if it be level, or nearly so, he takes hold of the wood by his teeth, and carries it forward. In the water he always transports wood or branches from one spot to another in a similar manner. His wood will, of course, float in the water, and, if left to float, would soon become embedded in the ice, which in ordinary winters, in this climate, is about 5 feet in thickness; he therefore takes it to the bottom of the dam, which has a depth of water of from 10 to 12 feet, and either fastens it on end in the mud, or covers it with stones, to prevent its rising, and it will thus at all times be available for his purpose. He is now nearly ready for the long winter. There is, however, something more to be done. I have mentioned that he digs a subterranean passage from his house to his dam; on each side of this, and in some instances widely apart, he makes holes about 5 or 6 feet in the bank, generally communicating in the interior with one another, and with the main entrance to the lodge. In one of these he takes his food, for he seldom or never eats where he sleeps.

The female has generally from three to six young at one time; the period of gestation is four months; and the young are produced, or first [redacted]

In the coldest weather, the top or roof of the lodge is always moist or wet, while the sides are frozen, at least outwardly. It is certain that he can remain under the water for half an hour at a time. He lives in the same lodge for two or four years, when, finding his food scarce, he removes to another locality, and builds as before.

For instinct or intelligence he is at the head of the wild animals in this country, and lives longer, I believe, than any of them. Other animals, as for instance the young of the American hare or rabbit, the marten and lynx, perish by thousands in the spring, either by cold, or in seasons of high water, or from lack of their ordinary food; but it is all the same to the beaver whether the season be wet or dry, hot or cold—the shores of every lake and the banks of every river furnish him with abundance of food.

I do not know whether he will thrive in Britain; at any rate, the Zoological Gardens is not the best place for him; he is fond of solitude, and does not like company. An island with a large lake would be the most eligible place for him, where, if set at large, he would soon shift for himself. Of course, his usual food would require to be found on the spot.

Dr J. A. Smith said, with regard to Mr M'Kenzie's statement that he could discover no air-holes in the lodges of the beaver, and wondered how they managed to do without air; it was probable the air got access through the comparatively looser structure of the top of the lodge, which Mr M'Kenzie states is always moist or wet even in the coldest weather, while the sides are frozen outwardly.

## II. *On an apparently New Form of Holothuria.* By JOHN ANDERSON, M.D. Plate XVI.

In the autumn of 1859 I dredged, from 5 fathoms of water in Bressay Sound, Shetland, the *Holothuria* which forms the subject of this memoir (Plate XVI. fig. 1). It was clinging to the inside of a dead and half-open *Modiola vulgaris*. When captured, it was of a cream-colour, slightly speckled with brown; but since it has been in confinement, it has sensibly deepened in colour. During the first months of its imprisonment it was very lively, especially at night; during the day, when exposed to the light, it always contracted itself into a little ball, confining itself to one spot, and that the one exposed to sun-light. The tentacles were always exposed at night, but were immediately retracted whenever any attempt was made to examine them. About the beginning of the second month of its confinement it became more sluggish, and remained for days contracted, never displaying its tentacles even at night. The body contracted so firmly upon itself, that many of the feet by which it was attached gave way, and were left sticking to the sides of the glass vessel in which it was confined. After remaining in this condition for some time, the integument about the centre of the body at last ruptured, and through the opening a portion of the viscera were protruded, which ultimately sloughed away; at the same time a considerable portion of the external skin desquamated, the animal not appearing to suffer much from the process, for the opening healed shortly afterwards. The animal has been kept in a small shallow vessel of sea-water, with only a little piece of sea-weed in it to keep the water in good condition. During by far the greater part of the nineteen months of its confinement it remained contracted, seldom moving from one spot. The only food it could possibly have obtained must have consisted either of microscopic animalcules or the spores of Algæ. The animal is still alive; and I am therefore not in a position to say anything regarding its internal structure.

The dorsal region of the body, when the creature is contracted, is of a deep purplish-brown tint, but the ventral surface is of a paler hue. The dorsal surface, when the creature is distended, approaches very much to the colour of the ventral aspect when in a state of contraction.

When contracted, it is little more than a quarter of an inch in length, and about the fifth of an inch in breadth; but when distended and moving about, it becomes double this length, and its breadth also is slightly increased.

The five double rows of sucking-feet are unsymmetrical, the two dorsal rows being irregular in their distribution. The dorsal feet are much less numerous than the ventral, and turns round to what appears to be its ventral surface. In the anomalous genus *Psolus*, as is well known, the locomotive organs are restricted to a small flattened ventral disk, on which the three developed rows of feet are disposed.

The arrangement of the feet in the animal under consideration is another instance of a like specialization of function, and indicates the tripod nature of the *Holothuriæ*. Viewed thus, this little animal is fraught with interest, and may serve to connect, by its gradation of form, the genus *Holothuria*, with its five well-developed rows of locomotive feet, and the genus *Psolus*.

The tentacles (Pl. XVI. fig. 2) are ten in number; eight of them are long, pedunculated, and alternately branched; and the other two are short and divided at their tips. They are all of a pale-yellow colour, very pellucid, and are about a fifth of the length of the body when it is fully extended. The two short tentacles correspond to the two tuberculated rows of feet of the dorsal aspect.

The body of the animal is covered with calcareous plates of an irregular form, perforated by nearly circular apertures (fig. 4). The plates found in the feet of the three ventral rows (fig. 7) are spindle-shaped; but they change their form in the feet immediately surrounding the head (fig. 8), and become in appearance very similar to the plates found on the body-skin. The plates of the dorsal tubercles and feet (fig. 3) resemble in their irregularity the plates of the body of the animal; and the same may be said of the plates occurring in the tentacles (fig. 6), in which they may be found extending to their ultimate divisions.

The very delicate structure of the feet enabled me to examine them microscopically in the living animal; and when so examined, a continuous circulation of a minutely granular fluid may be seen, the current consisting of two streams—one passing along one side of the foot to the sucking-disk, and the other flowing back from this structure to the body of the animal.

This little creature evidently belongs to Linnæus's genus *Holothuria*, which Van der Hoeven has lately revived with the following signification:—

"Feet of twofold structure and figure, some cylindrical, dilated at the tip, usually occurring in the abdomen only, others situated on the back, not dilated at the tip, emerging from warts on the back. Body cylindrical or flattened in the abdomen."

Having only found one specimen of this *Holothuria*, it would be premature, it appears to me, to describe it as a new species.

*Explanation of Plate* XVI.

Fig. 1. *Holothuria*, three times the natural size.
Fig. 2. Buccal extremity and tentacles.
Fig. 3. Calcareous plates of dorsal feet.
Fig. 4. „ „ body-skin.
Fig. 5. „ „ dorsal feet near head.
Fig. 6. „ „ oral tentacles.
Fig. 7. Portion of ventral foot, showing the form and arrangement of the plates.
Fig. 8. Calcareous plates from feet surrounding the head.

## III. *Notes on the Ornithology of Caithness.* By R. I. Shearer, Esq., Ulbster House, and H. Osborne, Esq., Wick. Communicated by John Alexander Smith, M.D.

### Part I.—*By* R. I. Shearer, *Esq., Wick.*

I have been induced to gather together a full and authentic list of all the birds hitherto found in Caithness, the main aim being to induce others to exert themselves in this delightful and interesting study; and I am confident that, had the ornithology of the county been understood and attended county in Scotland, and separated from the "storm-swept Orcades" by only the narrow belt of the Pentland, throughout the summer the few wooded tracts scattered over it resound with the melody of divers species of this delicate and lovely family. A wide and untrodden field lies here before the first intelligent student of nature who may be privileged to follow and observe these summer visitants in their sylvan seclusion. The plantations of Stirkoke, the woods surrounding Hempriggs House, and that paradise to the sportsman and naturalist the valleys of Berriedale and Langwell, are favourite and much-frequented resorts.

Previously to 1840, Dr Sinclair of Wick had collected and prepared with his own hands all those in the following list unmarked by an asterisk, amounting to the truly surprising number of 191; therefore it will appear that to the Doctor those interested in the subject are deeply indebted. Another reason for making this list is, that almost every other county has already a published register of its birds; and the rich and varied catalogue which this county can present can be surpassed by but few within the three kingdoms. Our diversified list exhibits species that can hardly be exceeded in richness of colouring by the gaudy inhabitants of tropical countries, such as the garrulous roller; natives of the warmer parts of Asia and Africa, such as the spotted flycatcher and the rose-coloured pastor; and, contrasted with these, those splendid strangers from the frozen regions of the Arctic circle, the snowy owl, the jer-falcon, and the ivory and Iceland gulls. As instancing what has been done in the way of illustrating the ornithology of this northern locality, I may in particular mention, although these are not the only works of a similar kind, the "Fauna Orcadensis" of the Rev. G. Low; the "Natural History of Orkney," by Messrs Baikie and Heddle; the "Tour in Sutherlandshire," by the late Mr St John; and the catalogue published in the "Zoologist," by that enthusiastic naturalist, Mr Thomas Edward of Banff. I also cannot omit noticing some of the very rare and valuable birds which Dr Sinclair has been fortunate enough to secure within the bounds of the county, although I regret not being able to give the details and date of the capture of many of them. Of these, by far the most interesting is the little bustard, very few specimens of which have been obtained even in England, where the only authentic instances of its capture in Britain have been recorded. Montagu's harrier, a species but lately discriminated from the common harrier, is a rare bird in the southern division of the kingdom, where its peculiarities and appearance first attracted the attention of the observant naturalist whose name it bears. The stock-dove, the ortolan bunting, the reed warbler, and the pomarine skua, although not exactly rare in the southern counties of England, have never, according to Mr Selby, been discovered by him north of the Tweed. Baillon's crake, the red-breasted goose, the ruddy sheldrake, and the hooded merganser, are among the very rarest British visitants, only one or two individuals of each species having been obtained, as recorded by the same authority in his "Illustrations." The additions made since 1840, distinguished by an asterisk, demand a passing remark. In the first order, the jer-falcon is added on the authority of the Rev. F. O. Morris, who relates in his "British Birds" that one was observed near Thurso, by W. M. E. Milner, Esq., M.P. The snowy owl has lately been pretty frequently found. The first notice of it was given by Dr Sinclair, who possesses three individuals, one of which, a mature bird, is perhaps the finest specimen in any collection in Britain. In the second order, the parrot crossbill was obtained by Mr G. Auld of Wick edly through inadvertence, he does not mention the ring dotterel (*C. hiaticula*), which is as common as the other is rare. In the fifth and last order three new species have been added—the bridled guillemot, found in abundance on our east coast every year, Richardson's skua, and an Ivory gull, found by myself. This bird is stated, on the authority of a celebrated Scottish naturalist, not to belong to the common species, but one new to the British list. I have not, as yet, ascertained its name.

The following is the complete list:—

### Raptores.—(*First Order.*)

*Falco Islandicus (*Jer-Falcon*).

Falco peregrinus (*Peregrine Falcon*), common.

Falco subbuteo (*Hobby*), rare. I once saw one of these birds with Charles Wilkinson, gamekeeper. It was killed at Thrumster.

Falco æsalon (*Merlin*), common.

Falco tinnunculus (*Kestrel*), rare in winter, common in summer.

Accipiter fringillarius (*Sparrow-hawk*), occasional; only in autumn.

Astur palumbarius (*Goshawk*), very rare; never to my knowledge.

Aquila chrysæta (*Golden Eagle*), occasional.

Aquila albicilla (*White-tailed Sea Eagle*), breeds.

Buteo lagopus (*Rough-legged Buzzard*), rare; only in Dr Sinclair 's collection.

Buteo vulgaris (*Common Buzzard*), rare. do. do.

Pernis apivorus (*Honey Buzzard*), very rare. do. do.

Circus cyaneus (*Common or Hen Harrier*), breeds.

Circus cineraceus (*Ash-coloured Harrier*), very rare. do.

Circus rufus (*Marsh Harrier*), rare. do. do.

Strix flammea (*White or Barn Owl*), rare. do. do.

Ulula stridula (*Tawny Owl*), rare. do. do.

Otus vulgaris (*Long-eared Owl*), bred last year.

Otus brachyotus (*Short-eared Owl*), breeds.

*Strix nyctea (*Great Snowy Owl*). An adult specimen, caught alive at Kilmster, was kept for some time by Mr Osborne, but it ultimately escaped.

### Insessores.—(*Second Order.*)

Lanius excubitor (*Great Ash-coloured Shrike*), thrice found. This bird was once captured by me in spring, in the act of attacking a linnet fixed in a hair snare, and itself got entangled also.

Cinclus aquaticus (*Water Dipper*), common.

Merula viscivora (*Missel Thrush*), common.

Merula pilaris (*Fieldfare*), common; seen in Caithness this year and last, in the beginning of August.

Merula iliaca (*Redwing*), common.

Merula musica (*Song Thrush*), common.

Merula vulgaris (*Blackbird*), common.

Merula torquata (*Ring Ousel*), common.

Saxicola œnanthe (*Wheatear*), common.

Saxicola rubetra (*Whinchat*), common.

Saxicola rubicola (*Stonechat*), rare; saw one this year in the month of June, near Lybster.

**Erythaca rubecula** (*Robin or Redbreast*), common.
Phœnicura ruticilla (*Common Redstart*), occasional.
Phœnicura Tithys (*Tithy's Redstart*), rare.
*Curruca atricapilla (*Blackcap Warbler*), obtained last autumn by Mr Osborne.
Salicaria arundinacea (*Reed Warbler*), occasional.
Sylvia sibilatrix (*Wood Warbler*), occasional.
*Sylvia hippolais (*Chiff-chaff Warbler*), first observed last autumn; seen this year also.
Regulus auricapillus (*Common Gold Crest*), common.
*Parus ater (*Cole Titmouse*), observed this autumn; also in spring of 1862.
Accentor modularis (*Hedge Accentor*), common.
Motacilla boarula (*Grey Wagtail*), occasional.
Motacilla Yarrellii (*Pied Wagtail*), common.
Budytes flava (*Yellow Wagtail*), rare.
Anthus pratensis (*Meadow Pipit*), common.
Anthus arboreus (*Tree Pipit*), rare.
Anthus aquaticus (*Rock Pipit*), common.
Bombycilla garrula (*Bohemian Waxwing*), occasional; generally found dead.
Muscicapa grisola (*Spotted Flycatcher*), occasional. This year and last year, about the end of May. Birds of the year seen frequently in a garden in Wick, in July.
Muscicapa luctuosa (*Pied Flycatcher*), rare.
Corvus corax (*Raven*), common.
Corvus corone (*Carrion Crow*), occasional.
Corvus cornix (*Hooded or Royston Crow*), very common.
Corvus monedula (*Jackdaw*), very common.
Corvus frugilegus (*Rook*), very common.
Pica melanoleuca (*Magpie*), very common.
Garrulus glandarius (*European Jay*), rare; probably introduced.
Sturnus vulgaris (*Common Starling*), common.
Pastor roseus (*Rose-coloured Pastor*), rare.
Coccothraustes vulgaris (*Hawfinch*), rare.
Coccothraustes chloris (Greenfinch), very common.
Carduelis elegans (*Common Goldfinch*), occasional.
Carduelis spinus (*Siskin*), occasional.

**Alauda arborea** (*Wood Lark*), rare. (?)
**Pyrrhula vulgaris** (*Common Bullfinch*), rare.
**Loxia curvirostra** (*Common Crossbill*), occasional.
**Loxia pityopsittacus* (*Parrot Crossbill*), rare.
***Picus minor** (*Lesser Spotted Woodpecker*), very rare; once observed.
***Yunx torquilla** (*Wryneck*); one shot at Stirkoke, and another at Rosebank, near Wick.
**Certhia familiaris** (*Common Creeper*), occasional.
**Troglodytes Europæus** (*Common Wren*), common.
**Cuculus canorus** (*Common Cuckoo*), common.
***Coracias garrula** (*European or Garrulous Roller*); seen at Ulbster, and watched for two or three days. It was always followed by a small bird, in the same way as the cuckoo.
**Caprimulgus Europæus** (*Night-jar or Goat-sucker*), common.
**Hirundo rustica** (*Chimney Swallow*), common.
**Hirundo urbica** (*Martin*), common.
**Hirundo riparia** (*Sand Martin*), common.
**Cypselus apus** (*Common Swift*), common.

### RASORES.—(*Third Order.*)

**Columba palumbus** (*Wood Pigeon or Ring Dove*), common.
**Columba œnas** (*Stock Dove*), very rare.
**Columba livia** (*White-rumped or Rock Dove*), common.
**Turtur migratorius** (*Turtle Dove*), occasional.
**Tetrao tetrix** (*Black Grouse or Black Cock*), common.
**Lagopus Scoticus** (*Red Grouse or Muirfowl*), very plentiful. These birds have frequently been reared and kept alive in an enclosure by Mr Osborne. They were very tame and familiar, and one pair bred on one occasion, hatching five healthy poults.
**Lagopus mutus** (*Common or White Ptarmigan*), common.
**Perdix cinerea** (*Common Partridge*), common.
**Coturnix dactylisonans** (*Common Quail*), bred in 1860. A pair bred at Ulbster; twelve eggs were laid and hatched; I shot two of the young and the old cock in autumn. Such was their desire to skulk when danger was near, that several were caught by the hand.
**Phasianus Colchicus** (*Common Pheasant*), common.
***Otis minor** (*Little Bustard*), very rare; once observed.

### GRALLATORES.—(*Fourth Order.*)

**Ardea cinerea** (*Common Heron*), common.
**Ardea purpurea** (*Purple Heron*), rare.
**Scolopax rusticola** (*Woodcock*), common.
**Scolopax major** (*Great Snipe*), rare.
**Scolopax gallinago** (*Common Snipe*), common.
**Scolopax gallinula** (*Jack Snipe*), common.
***Limosa rufa** (*Common or Red Godwit*). Only one specimen, shot at Ulbster Loch; two more were seen this year in the end of July.
**Totanus fuscus** (*Dusky Sandpiper*), rare.
**Totanus calidris** (*Redshank Sandpiper*), common.
**Totanus glottis** (*Greenshank*), rare.
**Totanus ochropus** (*Greenshank Sandpiper*), rare.
**Totanus glareola** (*Wood Sandpiper*), rare.
**Totanus hypoleucos** (*Common Sandpiper*), common.
**Totanus macularius** (*Spotted Sandpiper*), rare.
**Tringa variabilis** (*Purre or Dunlin*), common.
**Tringa canutus** (*Knot*), rare.
**Tringa rufescens** (*Buff-breasted Tringa*), rare.

Tringa maritima (*Purple or Rock Tringa*), common.
Tringa subarquata (*Curlew Tringa*), rare.
Tringa minuta (*Minute Tringa*), occasional.
Tringa Temminckii (*Temminck's Tringa*), rare.
Strepsilas interpres (*Turnstone*), occasional.
Numenius arquata (*Common Curlew*), common.
Numenius phæopus (*Whimbrel*), occasional.
Vanellus cristatus (*Lapwing*), common.
Squatarola pluvialis (*Golden Plover*), common.
Charadrius morinellus (*Dotterel*), rare. Shot on the Thrumster Moors, on a bare high hill.
*Charadrius hiaticula (*Ring Dotterel*), common.
Arenaria calidris (*Sanderling*) rare.
Hæmatopus ostralegus (*Oyster-Catcher*) common.
Rallus aquaticus (*Water Rail*), common.
Crex pratensis (*Meadow or Corn Crake*), common.
Crex porzana (*Spotted Crake*), rare.
Crex Baillonii (*Baillon's Crake*), very rare.
Gallinula chloropus (*Common Gallinule or Water Hen*), common. Specimens have been kept by Mr Osborne. They were very tame, and mixed freely with the poultry.
Fulica atra (*Common Coot*), common. The same remarks apply to the coot.

### Natatores.—(*Fifth Order.*)

Anser segetum (*Bean Goose*), rare.
Anser ferus (*Grey Lag Goose*), common, breeds.
Anser erythropus (*White-fronted Goose*), common.
Anser leucopsis (*Bernicle Goose*), rare.
Anser brenta (*Brent Goose*), rare.
Anser ruficollis (*Red-breasted Goose*), very rare.
Cygnus ferus (*Hooper or Wild Swan*), occasional.
Tadorna Belonii (*Common Sheldrake*), occasional.
Tadorna rutila (*Ruddy or Casarka Sheldrake*), very rare.
Anas boschas (*Common Wild Duck or Mallard*), common.
Querquedula crecca (*Common Teal*), common.
Querquedula acuta (*Common Pintail*), occasional.
Chauliodus strepera (*Gadwall*), rare.

were secured alive by some fishermen. This occurred in Ackergill Bay.

Colymbus arcticus (*Black-throated Diver*), rare.
Colymbus septentrionalis (*Red-throated Diver*), occasional.
Podiceps cristatus (*Crested Grebe*), rare.
Podiceps rubricollis (*Red-necked Grebe*), occasional.
Podiceps cornutus (*Horned or Sclavonian Grebe*), rare.
Podiceps minor (*Little Grebe or Dabchick*), common.
Uria troile (*Common Guillemot*), common.
*Uria lacrymans (*Bridled Guillemot*), common.
Uria grylle (*Black Guillemot*), common. This bird lays two eggs, though Mr Newman, in his work on Bird-nesting, says one. (See Macgillivray's "British Birds.")
Mergulus alle (*Little Auk*), occasional.
Alca torda (*Razor-bill Auk*), common.
Fratercula arctica (*Puffin*), common.
Phalacrocorax carbo (*Common Cormorant*), common.
Phalacrocorax cristatus (*Crested Shag or Green Cormorant*), common. Newman says the shag lays five eggs; I have never found but two.
Sula bassana (*Solan Goose or Gannet*), common.
Procellaria glacialis (*Fulmar*), rare.
Puffinus cinereus (*Cinereous Shearwater*), rare.
Puffinus anglorum (*Manks Shearwater*), rare.
Thalassidroma pelagica (*Storm Petrel*), occasional.
Thalassidroma Leachii (*Fork-tailed Storm Petrel*), rare.
Lestris skua (*Common Skua*), occasional. An individual of this powerful species was long kept alive by Mr Osborne. It was a handsome bird, the plumage being always kept in beautiful condition. It was extremely bold and fearless, but continued intractable and savage to the last. Captured in the adult state off Staxigoe.
Lestris pomarinus (*Pomarine Skua*), rare.
*Lestris Richardsonii (*Richardson's Skua*), common.
Lestris parasiticus (*Arctic Skua*), occasional.
Sterna hirundo (*Common Tern*), occasional.
*Sterna arctica (*Arctic Tern*), only lately observed, but tolerably abundant.
Sterna minuta (*Lesser Tern*), occasional.
Larus minutus (*Little Gull*), rare.
Larus ridibundus (*Black-headed Gull*), common.
Larus marinus (*Great Black-backed Gull*), common.
Larus fuscus (*Lesser Black-backed Gull*), common.
Larus argentatus (*Herring Gull*), very common.
Larus glaucus (*Glaucous Gull*), occasional.
Larus islandicus (*Iceland Gull*), occasional.
Larus canus (*Common Gull*), common.
Larus eburneus (*Ivory Gull*), rare.
* (*Ivory Gull*), new (see page 347). This gull was found flying about a small inland loch, in a very starved condition.
Larus rissa (*Kittiwake*), common.

### PART II.—*By* HENRY OSBORNE, *Esq., Wick.*

(The specimens of the Blackcap and Parrot Crossbill were exhibited.)

It will be observed, from the few additions made to the list of Caithness birds since 1840, that not much has been done either in the way of discovering or discriminating new species. Of the three last added, the chiffchaff (*Sylvia hippolais*) was shot at Ulbster, in July, by Mr R. I. Shearer, who subsequently procured another specimen. A fine male blackcap warbler (*Curruca atricapilla*) was shot by myself on the 16th October, and a female of the same species on the 28th (the birds were exhibited). Besides the fact of these birds being new to the Far North, the dates are so late that it has been matter of surprise to all who have heard of the circumstance, and know something of the economy of the bird, how such a delicate member of the family of *Sylviadæ* could possibly subsist at such a season in this climate. With the exception, however, that the male was not in song, both birds were as active and lively as they are described to be in midsummer, and both, too, were in perfect plumage. I have observed, in cases where the swallow has prolonged its stay with us until far on in the season, that there was an evident lack of that liveliness, vigour, and power of flight, displayed, for instance, in the month of June; but no such peculiarity was observable in the blackcaps. This, for the most part, perhaps, may be owing to the fact that the blackcap, when insect food is scarce, can subsist on the smaller fruits, while the swallow is wholly insectivorous. While under my own observation, the blackcaps fed principally on the berries of the mountain-ash. The Naturalist-Editor of "The Field" newspaper, in commenting upon the occurrence of the some woods near Lyth; but this species, as may be seen by the catalogue, has occurred once before, some fishermen having caught a male which alighted in their boat at sea.

In reference to the nesting of our birds, I am not aware that we possess anything either novel or peculiar; but a few random observations may not be altogether without interest. The most striking example of gregarious nidification the county can show, is exhibited on an island in the Loch of Stemster, where some thousands of the black-headed or laughing-gull (*Larus ridibundus*) congregate in spring. The eggs deposited on one-half of the island only are taken in the season, and these are lifted at short intervals, the numbers taken on some occasions being almost fabulous. They are valued as an edible of great delicacy. Round the edge of this island, among the rushes and other covert, several species build and rear their young. The nest of the mallard (*Anas boschas*), the eggs invariably concealed beneath the downy mass which the female plucks from her breast, is frequently met with, varied now and again by the massive and sometimes floating structure of the coot (*Fulica atra*). It is almost certain, also, that the tufted pochard (*Fuligula cristata*) breeds in the vicinity, as specimens are observed constantly throughout the summer months. In Mr Selby's time, this pochard was not known to breed in Britain, but the later work of Morris contains several instances.

The Arctic tern (*Sterna Arctica*) breeds, among other places, ina piece of moorland in the vicinity of a loch about four miles from Wick. In the breeding season this tern may be observed following the course of the river in its flight to and from its feeding-grounds, which are at the mouth of the river and round the bay. During its journey I have observed it occasionally, but not often, stop suddenly in its flight above the river, apparently attracted by some small fish, remain suspended, like the kestrel, for an instant, and then drop headlong upon the object that had attracted its attention. It is in the bay, however, where this bird chiefly finds subsistence; and here the habits of this tern, and of several species of gulls, may be observed under the most favourable circumstances. The principal prey of the

Arctic tern appears to be the sand-eel or sand-lance (*Ammodytes*). This rather curious fish appears in our bay occasionally in prodigious shoals; indeed, one of our most observant fishermen lately informed me that the masses of these fish he has seen on our coast exceeded by far anything of the kind he ever saw, not excepting the "races" or "banks" of herrings, which are described (principally by sanguine ship-captains) as being something prodigious. Large numbers of sand-eels are exhumed from a sandbank at the mouth of the river. They are used as bait, and numerous fishermen visit the bank when the tide has ebbed, armed with an instrument resembling a corn-hook, with which they dexterously drag to light the buried eel. I witnessed a foray of this description in spring last; but although this was not the first occasion, I was attracted in this instance by the number of sea-fowl that fluttered over the fishermen's heads, and came almost within reach of the weapons in their hands. The Arctic tern, the lesser black-backed gull, and the kittiwake were the species that joined in the pursuit. The kittiwakes were the boldest, or rather the most familiar, of the three; and at a distance, you could hardly say with certainty whether the eel just brought to light was destined to find the fisherman's basket or the kittiwake's maw. It was almost a neck and neck race, and Piscator very frequently had not much to spare.

That large and splendid species, the great black-backed sweep within reach, but their larger associate keeps far above, and seldom ventures within gunshot. On one of these "stacks," situated in Sinclair's Bay, I have seen shags and cormorants sunning themselves in every niche, the top even being occupied by numbers of these sombre gentry. The black-back is extremely wild and vigilant, and consequently difficult to approach; the only time when it ventures within reach of a gun, being in the breeding season, when it usually becomes a degree bolder. This gull is also very jealous of the neighbourhood of hawks and crows, having in especial an antipathy to the hooded crow. From its size and fierceness, it is generally monarch of all it surveys, the raven even succumbing to its attacks. In the last breeding season, however, the district received a visit from a stranger before whom all birds fled, the great black-back even making discretion the better part of valour. This was a white-tailed or sea eagle (*Haliætus albicilla*), and his presence evidently caused the more alarm, from the fact that an eagle is seldom or never seen in the vicinity. An observer who carefully watched this powerful depredator while beating the margin of a loch not far from the edge of the rock, saw him slip over the precipice and shoot along about half-way between the top of the cliff and the sea. Hardly had he made his appearance, when a rush of birds seawards took place. Everything that could fly left the rocks, and the terror and confusion that ensued was remarkable. This continued during the whole course of his flight, and his appearance was invariably the signal for a hurrying of the scared masses out of the reach of danger. So numerous, and so very much frightened were the birds, that the progress of the eagle could be traced, long after he himself was invisible, by the strings of seafowl, of various kinds, that persistently continued to seek safety in flight. It was long before gull and guillemot got over their fright, and matters resumed "the even tenor of their way."

The Arctic skua, the lesser black-backed gull, and the common gull, breed in a remote moorland district in the centre of the county. Here there are numerous pools or patches of water, known as "doo-lochs," of various sizes and shapes, studded with mossy mounds or islands, which are usually as high above the surface as the surrounding ground. On these mounds the birds, for the most part, rear their young with safety. Great numbers of eggs are destroyed, however, as, in consequence of there not being space enough on the detached portions for the multitude of birds that resort hither in the season, numbers of nests are built on the margins of the pools, which are robbed by herd-boys and occasional visitors. I have seen some excellent specimens of the Arctic skua shot in the neighbourhood of these lochs in spring last by a collector. The lesser black-backed gull does not restrict itself apparently in the choice of a situation for breeding, as its nest may be found inland on these moors, as well as on the "stacks" frequented by the great black-backed and herring gulls. In the inland district above-mentioned, the curlew breeds regularly, and I have good reason to believe that it also forms a breeding-station of the whimbrel (*Numenius phæopus*). The nest of the kestrel may frequently be met with along the east coast. A few pairs of peregrines still manage to rear a brood here and there amidst the precipitous rocks, but this bird exists in greatly diminished numbers. The sparrow-hawk is much rarer with us than the two species above-mentioned, or than the hen-harrier or merlin. The hen-harrier is known to breed in a retired hilly district about twenty miles from Wick. The merlin, the smallest and most beautiful of our falcons, builds its nest among the heather, usually selecting a situa- [redacted] ing every movement. Not a moment was to be lost, and the three, ranged in line, left their hiding-place and advanced rapidly on the nest. If the female still remains, her chance of escape is a poor one, for she is now within range of six barrels! She sits so close, however, that doubts are beginning to arise, when up she springs and dashes rapidly off, brushing the heather in her flight. She has not flown far when a single shot is fired, and poor falco drops among the heath with a broken wing. The male escaped on this occasion and was not seen again, although diligent search was made for some days afterwards. The nest contained four eggs, and was situated where one would rather expect to find the nest of the red grouse.

Dr J. A. Smith said, naturalists were indebted to Mr Shearer and Mr Osborne for their valuable list, with its accompanying details, of the birds of Caithness. He had requested Mr Osborne to add some notes on the nesting of the birds, and was sure the Society would agree with him in the great interest of these communications; he only wished a similar careful list of the appearance and nesting of the birds, could be got from all the counties of Scotland. The capture of the ivory gull, referred to by Mr Shearer as new (page 341), had been brought under the notice of the Society by Sir W. Jardine (see *Proc.*, vol. i. p. 4; and vol. ii. p. 57). The specimen was described by him as being the *Pagophila brachytarsus* (Halböll), and the first time it had been observed as occurring in this country.

### IV. Ornithological Notes.—*Larus glaucus* (Glaucous gull), *Mergulus alle*, (Little Auk), &c. (specimens exhibited). By J. A. Smith, M.D.

A fine specimen of the *Larus glaucus*, the great white-winged or glaucous gull, was sent for exhibition by Mr Edward Hargitt. It is a bird of this year, and was shot on Holy Island, near Berwick, in the third week of November. Dr Smith also exhibited a specimen of the Little Auk, recently shot in the Firth of Forth. This bird is an occasional winter visitor, generally after severe storms. It occurs abundantly in the Arctic regions; and he might mention in regard to it, that the late Professor Jameson used to exhibit a specimen, presented to the Museum of Natural History in Captain, afterwards Sir Edward Parry, which was captured by him in the year 1827, as far to the north as Lat. 82° N.

V. Dr Smith exhibited plaster casts of the skull of the famous *Gorilla*, and also of its brain cavity. Mr Alexander Stewart, No. 1 Surgeon Square, had been most successful in making these casts; and from him specimens could be obtained.

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*Wednesday, 26th February.*—JOHN COLDSTREAM, M.D., President, in the Chair.

Norman Bethune, M.D.; H. W. Mitnish, Esq., M.R.C S.L.; and William M'Nab, Esq., Royal Botanic Gardens, were elected members of the Society:—

The Secretary stated he had received from the Right Honourable Sir George Grey an official intimation of the Society's Address of Condolence having been duly presented to her Majesty.

The following Donations to the Library were laid on the table, and thanks voted to the donors: —

1. (1). Meteorological Observations made at Providence, R.I. By Alexis Caswell. October 1860.—(2.) Meteorological Observations made near Washington, Arkansas. By Nathan D. Smith, M.D. October 1860. —(3.) Researches upon the Venom of the Rattlesnake. By S. Weir Mitchell, M.D., Washington. January 1861. From the Smithsonian Institution, U S.A.—2. Second Report of a Geological Reconnoissance of the Southern and Middle Counties of Arkansas, made during the years 1859 and 1860. By David Dale Owen. Philadelphia, 1860. Presented through the Smithsonian Institution.—3. Proceedings of the [redacted]

office-bearers,—a young naturalist whose talents and extensive acquirements had given promise of much usefulness. Dr Coldstream said, that long and intimate acquaintanceship with the deceased enabled him to bear testimony to the thoroughness of his habits as a student; to his carefulness in research; to his probity and moral worth. Of his capacity for acute generalisation, the Society had been favoured with a striking proof in the able paper "On the State of our Knowledge respecting Metamorphism in the Mineral Kingdom," which he read in March last. This, along with a memoir on the effects of anæsthetics on plants, made Mr Livingston's talents widely known, and led him into extensive correspondence with men of science. His modesty and courtesy of manner were as remarkable as his acquirements, and endeared him to a large circle of attached friends. Dr Coldstream then submitted for the inspection of the members a large collection of drawings in water colours, of various Indian animals, chiefly insects, which had been made at the instance of Walter Elliot, Esq., lately a member of the Supreme Council of Madras. These remarkably beautiful drawings were executed by native artists, under the eye of Mr Elliot. The accuracy and elegance of the drawings were much admired, and a hope was expressed that many other residents in India would avail themselves, as Mr Elliot had so successfully done, of the talents of the natives, to extend our knowledge of the beautiful productions of our eastern empire.

## II. *Observations on British Zoophytes.* 1. Atractylis arenosa. 2. Atractylis miniata. 3. Laomedia decipiens. By T. STRETHILL WRIGHT, M.D. (Plate XV.)

### 1. *Atractylis arenosa.*

This zoophyte was described by Mr Alder at the last meeting of the Society. In September last I found a large female specimen at Largo, and was fortunate enough to have an opportunity of studying its anatomy and reproduction. The polyp-stems are, as Mr Alder has shown, funnel-shaped and expanding at the top. From them the milk-white polyps issue, each furnished with an alternating row of long tentacles. The scleroderm, or corallum, is covered by a thick layer of colletoderm, which is continued over the body of the polyp, and which, when the polyp retires within its tube, fills up the top of the tube by its cushiony folds, so that the polyp is completely hidden, and the funnel appears as it were closed by a valve. The colletoderm in my specimen was coated and impregnated with mud. Mr Alder's specimen was covered with grains of fine sand. I was at first inclined to believe that this zoophyte was merely a variety of *Atractylis repens*, which, with its medusoids, I have already described to the Society; but after it had been in captivity a few days, I found that it was beginning to put forth ovisacs, one on opposite sides of the polyp-stems (Plate XV. fig. 7).

The mode of reproduction in this zoophyte is unique amongst the Tubulariadæ, though I have noticed and described it in the Sertularias and Campanularias.

The female generative sac of *Atractylis arenosa* resembles that of Hydractinia; it is a simple sac formed of ectoderm, or the outer layer of the cœnosarc, enclosing a similar sac of endoderm, the "placenta," the whole being covered by a layer of scleroderm and colletoderm. Between the placenta and the ectoderm a large number of ova are developed, each showing a germinal vesicle and spot (fig. 8). When the ova are sufficiently advanced for extrusion from the generative cavity, the investments of the sac are ruptured, the sac assumes a long, cylindrical form (fig. 9), and a most labowhich still remains attached to the summit of the empty generative sac (fig. 10 *d*). The ova now undergo fissure, and are developed into planulæ within their nest, then at last escape, and, after swimming in the water, doubtless become fixed and converted into polyps.

*Atractylis arenosa*, although it gives off an immense number of young, is one of the rarest zoophytes on our coast, probably on account of the low viability of its planulæ. While *Sertularia pumila*, one of the commonest species, and which produces its young in the same way, will quickly line the vessel in which it is kept with forests of young zoophytes, not a single planula of *Atractylis arenosa*, of the immense number that were given off by my specimen, ever attained the polyp stage.

We have in this zoophyte the reappearance amongst the Tubulariadæ of a mode of gelatinous nidification, which obtains in various orders of the animal kingdom,—in the Protozoa, the Mollusca, the Annelidæ, the Insecta, and even amongst the Vertebrata, as in the common frog. We may ask, How is it that the ova of Hydractinia and Coryne are discharged into the water to float about without any protection, while those of *Atractylis arenosa*, the *Sertularias* and *Laomedias*, require such various provisions for their protection? but we do not find anything in the physiology of the zoophyte to answer the question.

### 2. *Atractylis miniata.* (New Species.)

Polypary yellow dendritic, branches given off at an acute angle from the stem, crooked, wrinkled but not ringed. Polyp with eight alternate tentacles, buccal cavity silvery, endodermal lining of stomach bright red-lead coloured. Reproduction not observed.

This zoophyte was found on stones at Largo, in little gnarled shrubby trees about an inch high, exposed at the lowest tides. The bright yellow colour of the polypary at once strikes the eye, which is also arrested by the gaudy colour of the minute polyps. These appear to be marked by two broad internal patches: one, corresponding to the buccal cavity, of a dense silvery white; the other to the cavity of the stomach, of a brilliant reddish orange. I have also found very minute specimens of this species at Granton

### 3. *Laomedea decipiens.* (New Species.)

Polypary minute; stem filiform flexuose, with from one to five branches, each bearing a cell; the stem is annulated with about five rings above the origin of each branch; the branches are annulated throughout; cells widening rapidly towards the top, with even double rims. Polyp, with about sixteen tentacles and trumpet-shaped proboscis.

This pretty little Laomedea resembles much the *Laomedea neglecta* of Alder, except that the margin of the cell is even, and has the appearance of being double for about half its length from the rim, though, from the extreme delicacy of the cell, this character is only made out with difficulty. The reproduction of this zoophyte resembles exactly that of *Laomedea lacerata*, except that each gelatinous nest of *A. decipiens* contains only three ova, while that of *L. lacerata* contains six or eight.

*Description of Plate* XV.—*Atractylis arenosa.*

Fig. 7. Polyp-stalk with two ovaries, the scleroderm covered by layer of colletoderm.

8. Ovary with colletoderm and scleroderm removed, showing layer of ova between endoderm and ectoderm.

9. Advanced stage of same: *a*, ruptured scleroderm; *b*, ectoderm; *c*, endoderm; *d*, layer of colletoderm.

10. Same, with ova extended into gelatinous nest.

within a short distance of each other; but no peculiarity is observable in the selection of their position; and, from all that is known at the present time, their place of site appears to be accidental, or at least chosen without any distinct motive. One of these circles, the far-famed stones of Callernish, occupies the flat of a ridge of hilly ground, while two others are near together on a wet and boggy moor, at the distance of a mile to the eastward of the first. If the circles situated on the moor had been visited two or three years ago, nothing but a few gray blocks even with, or protruding two or three feet above the bog, would have been seen, and even many of the stones of the large circle of Callernish were completely grown over and buried in peat. By the liberality of Sir J. Matheson these three circles have been excavated, and it was then found that the peat had accumulated to the height of between five and six feet. From an attentive examination of the foundation of these circles, I arrive at the conclusion that the stones were pitched before the growth of peat had commenced, or at least at the very commencement of the peat-forming epoch. The upright stones are founded in the (so called) boulder-clay which overspreads this, with most other parts of Scotland, and the peat rises uniformly from the clay to the surface, which would not be the fact if holes had been dug in the peat to receive the stones. Besides, some stones that had early fallen (in the smaller circles) rest upon the clay without any peat below them; and still further, in two of these circles are loose heaps of stones,—"cairns," as they are called, the grave-mounds of the illustrious dead,—which also rest upon the clay, without any intermediate floor of turf. If any peat had grown, it would be found beneath these cairns, for I consider it childish to suppose that it would have been cleared away. At the excavation of a tumulus at Stennes, in the Orkneys, which was presumed to be of or about the same age as the adjacent stone circles, the heath and moss on which the materials of the tumulus had been heaped were found in as good preservation as when the mound was made.

Besides the circles named, there are others, both in Lewis and Uist, which are only discovered by an occasional stone peering above the surface; and I see no reason to doubt that some of these Pagan monuments are entirely buried and out of sight.

I produce a stereoscopic photograph of the Callernish circle, which fortunately shows, by a difference in the depths of shade, the height to which the peat had grown around the stones; two of them, to the left hand, were entirely covered.

If, then, it is admitted that the stone circles of the Lewis were placed before, or only when the peat began to form, and that the peat has grown five feet since that time, it is evident that the least age of these monuments would be known if the annual increase of peat was known. But I am unacquainted with any data from which to form an estimate, and there is a wide difference in the opinions held on that point. One practical gentleman assured me that the Lewis peat grew an inch every year; at this rate the entire deposit might have taken place in about sixty years. Another estimate is nine inches in a century, but we require twice the number of years that this ratio would give to get back to Pagan times. As I am unacquainted with any class of facts that bears upon the subject, it is not worth while to offer any conjecture at the present time. I may mention, however, that to my surprise, one of the Lewis bards has a tradition that at one time there was no peat in Lewis; and it is also to be noted, that almost always, on excavating any of the Pictish dwellings, pieces of burnt stick (charcoal) are found at the fire-hearth. I do not wish it to be inferred, however, that there was no peat to be then found—

and growth of peat; in most books I see the observations of a certain Lord Cromarty are quoted, from which it is most illogically inferred that all peat is the result of the decay of forest trees. So wide spread is this allusion, that it has been quoted to me where the peat-banks were visibly and presently telling their own history. Without denying that the decay of forest trees in marshy ground will form peat, it requires only the most superficial observation to know that wood peat occurs only in the most homœopathic quantity in, at any rate, the islands of North Britain. It fortunately does occur as an exceptional instance, and then in so marked a manner as to leave no chance of confounding wood peat with the almost universal moor peat. The bulk of the peat of the northern and western islands is made up of the roots of rushes and moor-grass; the mosses help to keep it constantly wet, and the tormentilla (and probably other plants) supplies tan to the moss, and prevents it from decomposing into vegetable earth. Such were the conditions when the peat first began to grow, and such they still continue. I have looked over thousands of sections of peat banks in which there was no difference in the composition of the peat, from the base where grew the first peat-forming plants to the surface at the present moment, excepting consolidation towards the bottom from time and pressure. When the surface of a peat bank has been exposed for some time to wind and rain, the most solid, as well as the spongier portions of the peat will be found disintegrating into laminæ, which laminæ probably represent the annual growth, and if they were distinct enough to be counted would indicate the age of the peat. From whatever cause, there was a time when the general surface of the country was bare and lifeless, which was followed by a growth of plants, in no way differing from those that are now struggling for existence upon the moor. And from what has been said before, it would seem that man made his advent here at much about the same geologic time.

A common tradition of the Lewis is, that the ground was once entirely covered with forest trees, and that the wood was burnt down by the Northmen to deprive the aborigines of the shelter that it afforded. In almost all traditions there is some relation to fact; but without going into the history of this opinion, it will be enough to notice, that as far as I am aware there is but one place in Lewis where the remains of forest trees are to be found. The roots of firs over twelve inches in diameter occur near Balaline, in the parish of Lochs, and only there. These roots are always on the clay soil, for neither bush nor tree is found with its roots in the peat.

But although in a thousand cases the section of a peat bank, from its surface to its base, exhibits only a succession of marsh plants, a patient observer will here and there find a spot where the foundation of the peat is a floor of twigs and leaves. This, as stated before, bears only a minute proportion to the moor peat of the country. When examined it appears to be made up in great part of the twigs of the birch, but I have no doubt that the berry and bush of the mountain ash, the larch, the aspen, and the willow could be detected. In fact, it so happens that in this strange country, where many of the manners of the tenth century still exist, the method by which this peat of scrub and brushwood was formed can still be seen. On the small islets in the lakes, to which neither sheep nor cattle can gain access, a dense mass of scrub still survives. The heather will grow four feet in height, and above that may be seen the red berries of the mountain ash, or, if in spring, the catkins of the willow, or the pendant leaves of the aspen, with briers and brambles to interlace the whole. In the face of some cliffs and banks, and even in a few remote spots, the holly, hazel, aspen, birch, and willow, still struggle against an adverse climate as they did a thousand years ago.

I have been thus particular in pointing out the limited quantity of wood peat, and where it occurs, its position, resting upon the boulder clay, for a purpose to be more particularly described at the close of this paper; and I pass on to notice some important geological changes that have taken place in the most recent or peat-forming era.

My official duties led me last summer over several hundred miles of the most tortuous coast-line imaginable. Between North and South Uist lies the large island of Benbecula, and about five hundred others of different sizes and shapes; most of these can be approached on foot at low water, and the rest are only separated by shallow channels. On going round the coast I began to notice that the peat banks formed frequently the sea-margin at high water; and feeling that it was a point of some geological importance, I noted the places on my sketch of the coast, till at last finding that the phenomenon was extremely common, occurring perhaps twenty times in a day's walk, it was no longer necessary to record its occurrence. After examining hundreds of examples, I came to the conclusion that, in these instances, there was no other way of accounting for peat banks having that position with regard to the sea-margin, than by the subsidence of the land. In many of the cases referred to, the peat rests at once upon the naked gneiss. Now, the surface of the gneiss is as rugged as, and not very unlike what, the surface of the ocean would be if it were suddenly solidified in the middle of a violent storm. The peat has grown over the undulatory surface, but, as was to be expected, is deepest in the depressions, where I have sometimes seen it in section more than ten feet in height. Let it be supposed that the relative levels of land and sea remained the same until the formation of peat had occurred, and then that the land began to subside. The effect would be that when the sea reached the foot of the peat banks small cliffs would form, identical in their features with those of clay or gravel, or any other soft material. But from the extreme softness of the peat the sea would quickly eat it away, and work itself into all the sinuosities of the surface gneiss that were below the level of high water. This is what has happened around Benbecula; the sea at high water flowing in amongst the knolls, at first forming a simple gap, then branching out like the arms of a tree; at a further stage in the destruction of the peat, a group of islands is formed, till at last the whole vegetable soil is washed away, and a few bare rocks serve to point out where but one generation ago the cattle have pastured and corn has grown. Some of these rocks, which are now completely bare, still bear the names of particular plants that once grew upon them. It is difficult in words to convey an idea of the appearances and of the facts; but an inspection of the coast would show that the peat could only have been brought into its present position by the subsidence of the land. There are, indeed, but two other ways by which the peat can be found to form the sea-coast; one is by the action of the sea upon the shore, the other by the peat advancing to the sea by slip. But neither of these cases will apply to the sea threading in among the knolls and hillocks, eating out holes at first, which become pools, then lagunes, till at last the land that enclosed them is all gone. It must therefore be accepted as a fact, that the land has subsided (and is subsiding) since the peat began to form, and, consequently, that the stone circles of the Lewis are of an age anterior to that subsidence; it follows, then, that if the rate and quantity of subsidence were known, and supposing it to be uniform, we should arrive at the least age of the Pagan monuments.

Although we cannot arrive at the whole quantity, we have fortunately a measure of a part of that subsidence; this is afforded by what have foolishly been called submarine forests, but which are in fact submerged peat-banks.

In the Orkneys I have noted six places at which submarine peat is said to be found; at Otterswick, in Sanda, I have seen the people digging it at low water for fuel. The peat was mainly composed of twigs and leaves, and the seeds of the birch were plentifully scattered through it. There were also many gnarled pieces of wood, of the thickness of a man's arm. I was informed, on describing the kind of peat found at Otterswick, that the same sort of fuel may be got at Balranald, on the west of North Uist, at the level of low water. Peat also occurs below mud and gravel between tidemarks at the head of West Loch, Tarbert, in Harris; and Martin, the historian of the Hebrides, speaking of Pabbay, an island in the Sound of Harris, says, "The west end of this island, which looks to St Kilda, is called the Wooden Harbour, because the sands, at low water, discover several trees that have formerly grown there. Sir Norman Macleod told me that he had seen a tree cut there, which was afterwards made into a harrow." Several traditions could be added, of places now submerged that were formerly the sites of chapels or houses; and I think it may be taken as proved, that since the commencement of the peat-forming era, the land has sunk or subsided twelve feet at least; how much more, there are no means of finding out, for the submarine peat may have grown near to, or far away from, the high-water level; neither do we know how far the submerged peat-banks extend beyond the level of low water.

From the foregoing facts, it may be inferred that very soon after the climate of the Hebrides became such as to admit of the growth of vegetation, man emigrated to these shores, bringing with him the arts of agriculture and navigation, and a religion that induced him to honour the memory of his illustrious dead. Since then the tanned vegetable mould has accumulated to the height of at least five feet, and also since man's advent here the entire land has sunk twelve feet or more. These data may, by a more extended investigation, form a measure to the time of his arrival; at present I must content myself with having pointed out the facts.

## IV. *Description of several Fishes from Old Calabar.* By JOHN CLELAND, M.D., Glasgow. Communicated by WILLIAM TURNER, M.B.

The specimens now exhibited were given me by our late lamented Treasurer, Mr Oliphant, and it was his desire that they should be shown to this Society. They come from Old Calabar. They are not in very good preservation, but are sufficiently so for the determination of their characters. Besides a small specimen of *Chromis niloticus* (Cuv.), there is an *Eleotris* and four fishes of the family *Siluroidei*, none of which correspond with species described in the work of Cuvier and Valenciennes, or such other books as I have been able to consult. They may possibly be mentioned in recent monographs which I have not had an opportunity of seeing.

1. The *Eleotris* presents well the characters of that genus, the head being much depressed, the body slender, the eyes remote, the gape very large for the size of the body, and the lower jaw prolonged beyond the upper, so as to give the mouth an upward direction, which may probably be looked on as convenient to a fish inhabiting the muddy parts of the water, and preying upon animals swimming overhead. Also, it shows well the appendage behind the vent and the ununited ventral fins, which distinguish this genus from *Gobius*. It has no vomerine teeth; its scales are small; its total length to the tip of the caudal fin is five inches. The caudal fin is one inch long and rounded.

The number of the fin rays is as follows:—first dorsal eight, second dorsal ten, caudal thirty-two, anal nine, pectoral sixteen, ventral six.

2. Of the *Siluroid* specimens one is a *Synodontis*, and corresponds exactly with a specimen in the British Museum. I believe that it is the *Synodontis serratus*, although the number of its fin rays agrees rather with that attributed to *S. arabi* in the work of Cuvier and Valenciennes.

The anterior dorsal fin has eight rays, the first of which is, as in all the members of the genus, a long and strong slightly curved spine fixed at right angles to the body. This spine is toothed on its posterior edge, and towards the point anteriorly.

The posterior or fatty dorsal fin, half an inch high and two inches long, is continued further back than the posterior margin of the anal fin. The caudal fin is bifurcated, the superior half longer than the inferior. From the longest ray above to the longest below, inclusive, there are seventeen rays; and outside these there are eleven shorter rays in each half. There are thirteen rays in the anal, nine in the pectoral, and seven in the ventral fin. The first pectoral fin ray in *Synodontis* is a large spine toothed before and behind, the posterior teeth being longest, about equal in length to the dorsal spine. There is no locking arrangement in its joint, and therefore it can only be kept in the extended position by muscular effort. On the other hand we find the lock-joint of the pectoral spine in genera in which the dorsal spine is not fixed, as in this genus.

The superior scute of the head passes back nearly as far as the third dorsal fin ray. The coracoid scute is triangular, and passes back as far as the superior scute.

The long curved teeth which hang loosely in the lower lip, and which give character to the genus, are twenty-four in number. Behind them are fine velvety teeth, the patches of opposite sides distinct. In the upper jaw there is a double row of conical teeth, about eighteen on each side, and behind them (on each side) a patch of setose teeth of very irregular size.

There is one superior pair of barbules very long and simple, and two inferior pairs, both of them branched, the outer pair half the length of the superior pair, and the inner pair half the length of the outer.

The specimen is twelve inches long from mouth to tip of tail, and three inches from mouth to the first dorsal spine.

A view of the swimming-bladder of *Synodontis* is given by Müller in his work on Myxinoid fishes.

3. Two of the specimens exhibited belong to the genus *Clarias*, which is characterised by the presence of arborescent branchial appendages attached to the second and fourth branchial arches, and by having only one dorsal fin.

The first of them corresponds exactly to one which I have had the opportunity of examining in the British Museum, and which, therefore, we may expect to have properly described by Dr Gunther in his elaborate work, of which part is already published. The specimen is a foot long. The head is depressed and shielded, oblong in form, the eyes small and lateral; the body is oblong, compressed. The dorsal fin extends from within an inch behind the head back to the tail, but is not continuous with species, viz., *Clarias Nieuhoffi* and *Clarias jagur*, in the dorsal and anal fins being continuous with the caudal. It has only one arborescent branchial appendage on each side, which is attached to the fourth branchial arch, and is very small. The specimen is eight inches long to the tip of the caudal fin, the latter being three-fourths of an inch long. The head is depressed, not shielded, three-fourths of an inch long, the body compressed. The barbules are eight, the branchiostegal rays nine. The anterior superior barbules are broadly membranous at the base.

The teeth are velvety, the patch on the lower jaw is much larger than that on the upper, and there is a patch on the vomer.

The dorsal fin begins an inch behind the head; it has no spinous first ray. The rays in it and the anal fin are very numerous. The pectoral fins are small, and have six rays, the anterior ray being a short spine, less than half the length of the succeeding rays, and not lock-jointed. The ventral fins are small and contain three rays.

5. The remaining specimen is a species of *Heterobranchus*. *Heterobranchus* is a genus allied to *Clarias*, having the same sort of arborescent branchial appendages, but having two dorsal fins, the posterior of which is fatty.

The specimen is five and a half inches long, three-fourths of an inch of this length belonging to the caudal fin. The appendages will be seen on the second and fourth branchial arches.

The head is very much depressed, broad, shielded, the eyes lateral, the barbules eight.

The branchiostegal rays are eight. The first dorsal fin has thirty-five rays, the first one not spinous, it ends behind the middle of the body. The fatty dorsal fin extends from the true dorsal to the tail, and contains traces of eighteen very fine rays. The caudal fin has twenty-two rays; it is rounded, and is tipped with black, as are also to a less extent the other fins, and the dorsal aspect of the head is also black. The anal fin has forty-seven rays, and extends from anus to tail. The pectoral fin has ten rays, the anterior ray toothed and lock-jointed, shorter than the succeeding rays. The ventral fin has six rays.

The teeth are velvety, in elongated narrow patches, one of which is on the vomer.

## V. *Note of the Common Squirrel* (Sciurus vulgaris) *Feeding on Birds and their Eggs.* By Thomas Durham Weir of Boghead, Esq., Bathgate. Communicated by Dr John Alex. Smith.

The far-famed Charles Waterton of Walton Hall, Esq., near Wakefield, in his amusing and highly interesting Essays on Natural History, has strongly maintained that the squirrel derives its supplies of food wholly from the vegetable kingdom, and is not possessed of any carnivorous propensities. I shall however prove from a few facts, for

> "Facts are chiels that winna ding,
> And canna be disputed,"

that this is not the case, but that some members of this family are not true vegetarians, and do occasionally indulge in carnal feasts.

Hear what Mr Waterton says in reply to a published account of a tame squirrel eating flesh in confinement:—

"Had the squirrel been wild in the wild woods at the time that Mr Wigton saw it eat birds, I should not hesitate to pronounce that individual squirrel to be carnivorous, because I believe that Mr Wigton would only state what he conceived to be correct. I gather from Mr Wigton's communication that his squirrel was in captivity when it partook of a carnal feast. This single fact at once precludes the possibility of the Squirrel family being raised to the rank of carnivorous animals. The incarceration only of a few days might have injured the prisoner seriously, either in his nervous system, or in his gastric powers, or in his olfactory sensibilities."—Now for my facts:—

A few years ago, during the month of May, Mr James Hunter, a respectable merchant in Bathgate, upon whose veracity I can place perfect reliance, informed me that whilst walking through the plantations of Andrew Gillon, Esq. of Wallhouse, he observed a squirrel sitting upon the branch of a tall larch. Being near to the farm-steading of Broom Park, and anxious to get it for a specimen, he brought out the son of the farmer, who immediately shot it. To their astonishment they found a small bird firmly clutched in its claws, with its skull laid open, and the brains taken out.

James Bell, another observer, told me that when walking [redacted] paws, and proceeded to devour with apparently the greatest relish. Not contented with this, it was in the act of taking another from the nest, when the enjoyments of the feast were broken in upon by the hitherto unseen observer of the depredation.

### VI. *Albino Variety of the* Lepus timidus. Exhibited by John Alex. Smith, M.D.

This white variety of the common hare was shot near Lauder about the end of January. The animal was large, and well fed. The eyes were carefully examined, and were pink or red, showing the usual deficiency of the dark pigment of the eye, which occurs in albinos. The ears, which were longer than the head, had no black colour on their tips; and the upper part of the tail, instead of being black, as in the common and Alpine hares, was, like all the rest of the animal, pure white.

### VII. *Ornithological Notes.* By John Alexander Smith, M.D. (Specimens exhibited.)

(1.) Turdus Merula (Penn.) *Blackbird.*—A pied variety of this bird was exhibited, the head and upper parts of the body being variegated with numerous pure white feathers. It was shot on the 3d of February near Dundas Castle, Linlithgowshire.

(2.) Loxia curvirostra (Penn.) *Common Crossbill.*—A male and female, in fine plumage, were exhibited, killed on the 13th January, near Aberdeen.

(3.) Picus Major (Penn.) *Pied or Great Spotted Woodpecker.*—Adult male specimen, showing the crimson red occiput, was found in May 1861 lying dead in the shrubbery of T. Durham Weir of Boghead, Esq., near Bathgate, Linlithgowshire. The bird seems not to have been before observed in this county; it is not included in the list of the birds of Linlithgowshire, by the Rev. John Duns, recently published in the Proceedings of the Royal Society. A young male, shot on the 4th of last December, at Kirkwall, Orkney, was also exhibited. It is one of our rare local residents, and is an accidental visitor or straggler in Orkney. Another specimen was killed in Orkney in the month of August last, and was sent to Mr J. Carfrae, Princes Street, to be preserved.

(4.) *Hybrid Grouse, between Blackcock and Red Grouse.*—Two male, apparently hybrid grouse, in very fine plumage, were exhibited. They show a resemblance to both parents, and their size is intermediate between them; being rather less than that of the male blackcock, and 18 inches in length from point of bill to middle of forked tail. The upper parts of head and body are black, mottled with reddish-brown and grey; the breast is black, with slight reddish purple reflections; the under parts black, mottled with red, and spotted with white. The birds have the blackish bill of the blackcock, and the scarlet free fringed margin of membrane over the eyes, as in the Red Grouse.

Tail is slightly forked, and differs from Macgillivray's specimen, in having eighteen feathers like the Blackcock, instead of sixteen as in the Red Grouse.

The legs have the tarsi closely feathered all round, like the Red Grouse, there being no bare space on the back part, as exists in the Blackcock; and the feathers are as close and thick as in the former. The feet are feathered for about a third down the toes, whereas in the Blackcock the feathering stops at the commencement of the toes, and in the Red Grouse it extends down to the claws. The toes are margined with pectiniform scales, as in the Black Grouse; and the claws are long, arched, and slender, like the Red Grouse, and do not resemble the shorter and stronger claws of the large frog was much altered by the digestive process, but its hind legs, which projected upwards into the gullet, were very little changed. The caput cæcum was small, measuring only about one-eighth of an inch, and had no projecting cæcal appendages. Another specimen, a female, was also examined; it was shot in October last, between Ayton and Coldingham, Berwickshire.

(6.) Podiceps cristatus (Penn.) *Great Crested Grebe*, (*"pellet" in stomach*).—The specimen exhibited was shot in the Firth of Forth, near Queensferry, on 27th January 1862. It measured 21 inches in length; wing from carpal joint to point of primaries, 7¾ inches. Bill nearly two inches in length, of a pale carmine tint, with a dusky stripe along its ridge, and tip of greyish white; small white spot between eye and bill. In wing, the primaries are brown, one or two of the last being slightly tipped with white; secondaries pure white, with the exception of two or three of the last feathers, which are more or less tipped with brown, and the coverts of the primaries and secondaries are brown; the humeral feathers and their coverts are pure white, and this white colour runs forward along the lesser coverts at the anterior margin of wing, gradually diminishing in breadth towards the carpal joint. The scapulars are dark-brown or greyish-brown, like the rest of the back. The expanded wing, therefore, displays the primaries brown, and a broad band of brown obliquely crossing the white wing from the carpal joint to the points of the last secondaries. The axillaries are white. Feet and legs greenish-brown on outside; inside, pale yellowish-green. The bird is a female; the muscular gizzard measured 2½ inches in length, with a thick, rugose cuticular lining; it contained a nearly dry rounded mass, about the size of a small walnut, which, when broken up by the finger, was seen to consist of various black and white feathers, apparently taken from the bird itself, and the remains of what appeared to be the spines and skins of shrimps or other crustaceans. Masses of this kind have been often noticed in the stomach of this bird, and have been variously described. The pyloric orifice of the stomach was seen to be very small, and it was at once apparent the mass of feathers never could be passed by the bowels; whereas the cardiac opening of the stomach was large, with a large glandular proventriculus, forming a band 1½ inch in breadth. It was manifest, therefore, this mass was simply a "pellet" of feathers, and the indigestible parts of its food, ready to be cast up by the mouth. From the lower bowel there were two cæca, one 1¾, the other 2¼ inches in length.

Macgillivray, in his "History of British Birds," says, "Its food consists of fishes of various kinds, aquatic insects, reptiles, and crustacea. Along with remains of these are usually found in the stomach numerous large curved feathers, which it probably picks up as they float on the water, and which are no doubt intended to facilitate digestion." How, he does not tell us.

In Professor Fleming's "British Animals" we are told that he found in the stomach of a young *Podiceps cornutus* "a concretion upwards of half an inch in diameter, consisting of its own belly feathers, closely matted together. Montagu, in his Supplement, states, that he observed the same occurrence in the red-necked and crested species. Are these to be considered as analogous to Bezoar's ?"

Yarrell, in his "British Birds," alludes to "this habit of the grebes swallowing feathers alone," and says it "appears to be peculiar to the grebes only. From fish bones being found occasionally mixed up with the feathers, there is cause to suspect these birds bring up the more indigestible part feathers of lower part of neck, was shot on the River Tay, in the month of January, and is exhibited by my friend, P. A. Dassauville, Esq. A young specimen was obtained from the stomach of a cod, by our member, Dr John Anderson. The bird was in good preservation, and was presented by him to the Natural History Museum of the University; the cod measured 3½ feet in length, and was not in good condition; it was caught in the month of November on the east of the Isle of May. The Red-necked Grebe is stated to be more decidedly marine in its habits than others of the grebes; and this instance of its capture by the cod fish, may perhaps be considered an additional proof of the correctness of this opinion.

(8.) Podiceps cornutus (Penn). *The Horned or Sclavonian Grebe.*—A male and female in their full summer plumage, in the possession of Mr Sanderson, George Street, were exhibited. They were shot on the 20th of June 1860, by Farquhar Campbell, Esq., at the small loch of Killisport, on his property of Ormsary, Argyleshire. These birds are not known to breed in Scotland; in this instance, however, from the season of the year, and from the locality to which they seemed attached, they were considered as probably rearing a brood of young.

(9.) Podiceps auritus (Penn). *The Eared Grebe.*—The bird exhibited was found by Mr John Blackwood, George Street, in the early part of January, on the sea-beach within the grounds of Dalmeny Park, near Edinburgh, the seat of the Earl of Rosebery. It is easily distinguished from the other grebes by its small size, being still less than the species last noticed (this bird measured about 12 inches in length); and by the peculiarly recurved or bent up character of its bill, which is also shorter than the head. The upper mandible is broad at the base, and is depressed a little in the middle of its length; its outline rising slightly upwards towards the tip. The outline of the lower mandible is nearly straight at the base, and rises rapidly upwards towards the point, giving it the appearance of being cut off obliquely at the point. The bill is black, tinged with blue, and horny white at the tip, the base of lower mandible being yellowish. This specimen is probably a young bird in winter plumage; it has the upper parts of head nearly black, feathers rather prolonged at sides of hind head; neck and back brownish-black; chin, and across upper part of neck white, a greyish band crosses front of neck; and below it is silvery white, the flanks being dashed with brown. Wing: primaries, dusky, first and second nearly equal, rest gradually diminishing in length; secondaries, pure white; the coverts brown; below, white; length from carpal joint 5 inches. Legs and feet dark green, rather lighter on inside. Macgillivray says he has very seldom met with this bird in Scotland; and Sir William Jardine states he has never personally found it. It is the rarest of the British Grebes.

VII. A Large Specimen of the Wild Cat (*Felis catus ferus*), recently shot on the property of the Earl of Seaforth, in Inverness-shire, was exhibited by Edward Hargitt, Esq.

VIII. MR ROBERT BROWN *exhibited to the Society a beautiful specimen of* Astrophyton scutatum* *from Davis Strait, with the following Note.*

Twelve months ago to-day I sailed to the Arctic Regions, for the purpose of studying some points in Natural History to which my attention had of late been directed. During the eight months I was away, I visited various parts of the Polar Regions, the seas round Jan Mayen, Spitzbergen, and the east coast of Greenland, the west coast of Greenland, and has well repaid me for any little hardships and dangers I may have undergone in gaining it; and I take this opportunity of thanking Captain George Deuchars of the s.s. "Narwhal," and his officers, for the ready and intelligent assistance they tendered me whenever it lay in their power. The few observations which I have been enabled to make, I shall have the honour of laying before the Society at a future time. In the meantime I exhibit this specimen of *Astrophyton scutatum*, Link, Flem., *et* Forbes (Brit. *Echin.*, p. 67), which I obtained, in September 1861, on the west side of Davis Strait, about a mile off Cape Kater, clinging to a whale line, from 150 to 200 fathoms—rocky and clayey bottom. It was laden with ova of a deep-red colour. I found nothing in its stomach but Diatomaceæ, and a specimen of an Entomostracan, closely allied to, if not identical with, *Cetochilus arcticus* of Baird, in the "Appendix to Sutherland's Voyage," vol. ii. p. cciii., the presence of which, however, may, with a specimen of a species of *Yoldia* embraced in its arms, be only accidental. (It may be mentioned as a curious fact, that this Cetochilus forms a great portion of the food of the "commercial" whale (*Balæna mysticetus*), a much disputed point, and of some of the minuter species of Acalephæ.)

*Astrophyton scutatum* has been occasionally got among the Northern Isles of Scotland (where it bears the rather classical name of *Argus*) and Norway.*

It has been found, however, very rarely, and at distant periods, in the Arctic seas. Otho Fabricius, in his remarkably accurate *Fauna Grœnlandica* (Hafniæ et Lipsiæ, 1780), speaks of it (p. 372) as follows:—"*Asterias caput medusæ.* Hanc in museo plurimum reverendi Dn. Egede de colonia Jacobshavn (ni fallor) missam, vidi: unde concludo, in sinu Disco dari; non autem vivam ipse offendi."

Whether Fabricius refers here to Hans Egede, the pioneer missionary of Greenland (1721), or to his son, Paul Egede, also a missionary in Greenland, and both of whom published works on the country, does not appear, though in none of them can I find any account of this animal. The Chevalier Charles Louis Giesecke, who passed several years in Greenland, engaged in the study of its Natural History, in his article "Greenland," in the Edinburgh Encyclopædia, vol. x. p. 502, notes as follows:—"In Disco-Fiord is found the *Asterius caput medusæ.*" He is apparently here, as in many other places, only copying the doubtful record of its occurrence by Fabricius.

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* The secretary of the Zoological Society lately exhibited a specimen at one of their meetings from the southern seas. ("Habitat in omni oceano, imprimis Pelagico."—*Linn. Syst.*, i. 663, Ed. 10.)

There is no notice of it in Hans Egede's work on Greenland (*Die Gæmle Grœnland nye Perlustration*, 1729); or in the fuller and better work by David Crantz, one of the Moravian Unitas Fratrum (*Historie von Gronland*, 1765; English trans. 2 vols. 1820), both of whom studied very closely the Arctic Fauna with the best lights of the age. My attention has however been called to a note by Mr Gwyn Jeffreys, in the "Annals of Natural History," vol. vii. p. 253, where he refers to Sir John Ross having got a single specimen far north, which was described by Dr Leach, under the synonym of *Gorgonocephalus arcticus*, and is now in the British Museum. It was obtained from 1600 fathoms soundings in soft mud, and measured, when expanded, two feet.*

My specimen is much larger and finer than any I have ever seen got in the British seas. It thus appears that, with the exception of the doubtful indication of its occurrence in Disco Fjord, by Fabricius (*circiter* 1760), and that by Sir [redacted] narrow inlet of the Island of Disco (lat. 68° 58′ 42″ N., long. 53° 13′ W.), appears to be a very likely place for it. It is almost opposite Cape Kater where I got it, and where it appears to be pretty abundant; for broken pieces occasionally came up on the whale-lines afterwards.

A curious idea seems to have prevailed in Bishop Erick Pontopiddan's day regarding this animal. After mentioning in his excellent "Natural History of Norway," part ii. pp. 179–80 (Lond. 1755, English trans.), that it is rarely got on the Norwegian coast, and is called Söe-Navle by the Norwegians, and Söe-Soel or Sea Sun by the Dutch sailors, who frequently find it in the West Indies, according to Geo. Marcgrave's account, in his "Historia Naturalis Braziliæ," lib. iv. cap. xxii., he states, in all good faith, the following extraordinary notion, though, with a lack of credulity he has hardly been given credit for, repudiating it:—"This strange and wonderful fish or korstrold is said to be only the young, or perhaps only the germ, of the roe of that great and frightful monster, which is here called Kraake [Kraken *Anglice*]. But as far as I could get information from several fishermen, who all agree in their accounts, this cannot possibly be true."

Though a rare animal, this "Korstrold," from its bizarre form, seems to have attracted the attention of all the "engenuous" naturalists of an early date, as well as more modern, and to have received (after a fashion not peculiar to our time) a variety of names,—viz., *Sternfisch*, J. C. Adelung, *Geschicte*, &c., p. 381, tab. xvii. fig. (1768); "*Stella marina* I. Ionstoni, *Insect.*, tab. xxiv. fig. 11" (*fide* Fab.); *Stella arborescens* (Rondoletius and Gesner); *Asterias caput medusæ* (Linnæus, Müller, &c.); *Asterias arborescens* (Pennant); *Euryale verucossum* (Lamarck); *Euryale scutatum* (Blainville), &c.

Most of the early authors give distinguishable figures of it. That of Pontopiddan is the best. Among modern, that of Professor E. Forbes is the only good portrait of it, but, from its want of colouring, his figure does not do full justice to the varied hues of the starfish. The coloured figures in Griffith's beautiful edition of Cuvier's *Regne Animal*, as also in the "*Crochard* Edition" of same work, are mere pictures.

**_Wednesday, 26th March_ 1862.—ALEXANDER BRYSON, Esq., President, in the Chair.**

**The following Donations to the Library were laid on the table:—**

**1. Canadian Journal, New Series, No. 36, November 1861.—From Canadian Institute. 2. First Report of a Geological Reconnoissance of the Northern Counties of Arkansas, made during the years 1857 and 1858.—From Geological Surveyor of Arkansas. 3. Fourth Report of Progress of the Geological Survey of Missouri.—By G. C. Swallow. 1859.**

**The following Communications were read:—**

### I. *Notice of Indian Insects exhibited at last meeting by Mr Elliot of Wolfelee.* By R. F. LOGAN, Esq.

Although not present at the last meeting of the Society, when Mr Elliot's beautiful drawings of Indian animals by native artists were exhibited, I have since had the pleasure of inspecting them, through the kindness of Dr Coldstream; and with reference more especially to the entomological portion of the collection, I wish to bear testimony not only to the intrinsic beauty and fidelity of the drawings, but also to their high scientific value, as comprising the transformations of many insects whose history has been hitherto unknown to science. Besides figures of the larvæ and pupæ of many of the *Papilionidæ*, *Pieridæ*, *Nymphalidæ*, &c., some of which have been already figured and described, the collection includes some most interesting details of the transformations of the *Heterocera*. Among the *Noctuæ*, those of the larva of *Notodonta* or *Amphipyra*, and the rest of the body is uniformly cylindrical, the fifth and the sixth segments bearing a pair of large eye-like spots, somewhat like those of the larva of *Chærocampa*. The position, when at rest, is most remarkable, the body resting on the three pairs of perfect ventral claspers alone, with the anterior segments elevated and incurved, after the manner of the *Sphinges*, and some of the *Geometræ*, while the posterior segments are elevated in the air after the fashion of the genus *Notodonta*.

The drawings are on their way to London, I believe, to be placed in the hands of Mr Moore; so that their details may be expected to be embodied in the forthcoming volumes of the Descriptive Catalogue of the Insects in the Museum of the East India Company.

## II. *Notice of the Development of Fish Spawn from the Firth of Forth.*

By James M'Bain, M.D., R.N.

On Tuesday the 11th instant, when examining fish spawn under the microscope, I observed a free and complete rotation of the embryo in the ovum, which rotatory movement was repeated at short intervals. The spawn had been dredged up four days previously in 14½ fathoms water, half a mile to the westward of the Isle of May; and in all the ova which had a clear transparent appearance the same rotatory motion was observed. The following day, on making similar observations, the embryos were still found alive, and rotating freely in the ovum; and fresh spawn dredged up at the same place exhibited similar activity of embryonic movement. The spawn in which this vital action was seen is said by the fishermen to be the herring spawn; and to ascertain, if possible, to what species it really belongs, I preserved small portions of the spawn in sea-water. On the 18th instant, I was pleased to see a numerous brood spontaneously extruded from the ova, swimming freely about in the vessels in which they had been placed.

The ova were about $\frac{1}{20}$th of an inch in diameter, and the young fry, when first extruded, measured two to three lines in length. A few of the young fish are now, eight days after extrusion, fully half an inch long, and have almost parted with the nutritive portion of the vitellus. There are many, however, that have made less progress, and have still a large yelk-mass attached to the upper part of the thorax immediately behind the pectoral fins. On the third day after exclusion from the ova, the mouth and jaws were quite distinct, the pectoral fins had appeared, and the outlines of the branchial arches were plainly visible. The cardiac contractile sac, which was seen in the embryo, was now found to contract and dilate sychronously with a fluid movement along the ventral aspect, which could be traced backwards four-fifths the length of the fish, where a notch in the delicate fin membrane appeared to indicate the separation between the abdominal and caudal portions of the animal. The progress of development has been watched daily, and will be more fully detailed when the observations are completed.

As it is uncertain whether the young fry will exist long enough to pass into their adult condition, I have thought it proper to give this brief notice to the Royal Physical Society, and at the same time to exhibit living specimens, along with pencil drawings illustrating the various phases of development from the first rotation of the embryo seen in the ovum until the present time.

Dr T. S. Wright mentioned that he had noticed a similar development, but was doubtful if the ova were herring teresting, and, according to its discoverer, Rathke, "recht selten parasit." As it is a new and interesting addition to the fauna of the Scottish seas, I shall shortly describe its external characters. This remarkable Bopyridian is fixed with its dorsal surface to *P. Bernh.*, and from its anomalous position, one is apt to confound the ventral with the dorsal surface of the body. By means of its seven prehensile feet it adheres with considerable tenacity to the soft abdomen of the crab. In Phryxus, as in the other Bopyridæ, the proportions of the female greatly exceed those of the male individual, which is always found associated with, and leading a parasitic life upon, the former. Differing in size, they also differ in external form.

The female always selects the left side of the crab as its *habitus*, which, I suppose, is owing to this side of the crab being always in relation to the widest part of its appropriated dwelling. It is about half an inch in length and a quarter of an inch in breadth; all my specimens were of a pure white colour. The body of the animal, with the exception of the caudal appendage, is nearly of the same breadth throughout its whole extent; its anterior margin is rounded. As already stated, the dorsal surface is applied to the abdomen of the crab, and is flat, but slightly concave in the centre, and is divided into seven segments, each segment bearing a pair of prehensile feet. The ventral or uppermost surface is in relation to the shell in which the crab lives, and, like the dorsal, is distinctly segmented, but is hidden from view by six leaf-like membranes, which form the breeding cavity for the ova.

The head of the animal cannot be detected on the ventral surface until the bladder-like pouches which overlap it are removed. This portion of the head consists of a large under lip, behind and over which are placed two valve-like bodies; these bodies, in reality, are the altered pouches of the head segment. When viewed from the dorsal aspect, the head has a quadrangular appearance, bearing upon the centre of its anterior margin a small rounded process. The first pair of antennæ are small, and consist each of three joints, the terminal joint bearing a few bristles. The second pair are much larger than the first; they consist each of four joints, the two terminal joints being provided with a few bristles. Eyes are wanting in the female.

The segments of the dorsal surface of the body are symmetrical, with the exception of the sixth, the unsymmetrical character of which is due to the animal being slightly curved, the convexity of the curve being towards the right side, and involving this segment. The segments gradually increase in size from the third to the sixth; the latter is very much expanded on the right side of the mesial line, corresponding to the convexity of the curve of the body. The seventh segment is symmetrical, but very much smaller than the preceding one. All these segments bear feet, which are very much distorted. From the different relative proportions of the segments, the feet are placed at various distances from each other. The first pair closely surround the head, and have the second pair intimately applied to their external margins. The third pair are placed very near the second, but slightly posterior to them; and the fourth pair are removed at some distance from the former, and also from the fifth pair, which lie behind them. A considerable interval exists between the fifth and sixth pair of feet, which is especially marked upon the right side of the animal. The sixth and seventh pair lie contiguous to one another.

Projecting beyond the posterior margin of the body (seventh segment) are the five branchial segments, all of upon its ventral surface four rounded tubercles, and has a curious crescent-shaped pedunculated appendage attached to the posterior extremity of its external margin; the posterior portion is about half the size of the anterior, and is convex externally, and slightly concave on its internal margin.

The connections of the remaining five pouch-like membranes are as follows:—

The 2d belongs to the 1st Thoracic segment.
„ 3d „ „ 2d . do.
„ 4th „ „ 3d and 4th do.
„ 5th „ „ 5th and 4th do.
„ 6th „ „ 5th, 6th, and 7th do.

The second membrane covers the valve-like leaf of the head and is overlapped by the third, which is partially covered by the fourth; this, again, overlaps the anterior extremity of the fifth, the remainder of which, and the posterior half of the fourth, are hidden from view by the largely developed pouch of the fifth, sixth, and seventh segments. By this arrangement the plates visible from the belly side are the third, fourth, and sixth. The sixth plate is minutely serrated along its margins. In one of the specimens I examined, the fourth, fifth, and sixth membranes were filled with ova.

The pale-yellow coloured male is a very little more than one line in length, and consists in all of nine segments, which diminish in size as they approach the caudal extremity. The anterior segment (head) is symmetrical, and bears two eyes. Projecting beyond its lateral margins are the external antennæ, which consist of four joints. Placed internal to these, and completely concealed by the head, are the internal ones, which only consist of three joints. Each of the remaining segments, with the exception of the terminal one, carries a pair of feet which are provided with sharp claws. The segments are rounded at their external margins.

## V. *Observations on British Zoophytes and Protozoa.* 1. Clava nodosa. 2. Acharadria larynx. 3. Zooteirea religata. 4. Freya (Lagotia) obstetrica, Freya stylifer. 5. Chætospira maritima. 6. Oxytricha longicaudata. By T. Strethill Wright, M.D. (Plate XVII.)

### 1. *Clava nodosa* (n. sp., T. S. W.)

"Polypary creeping. Sclerodern membranous, 'Polyps single, small, aurora-coloured, each springing from a small knot of convoluted tubes.' This zoophyte was found on the fronds of *Delesseria sanguinea* at Queensferry and Largo."

The very delicate threads of the polypary creep over the fronds of the seaweed, and at intervals twine themselves into a convoluted knot of membranous tubes, from which a single polyp arises. The species occurs only at low tide mark; while *C. repens*, for which it may be mistaken, is found in shallow rock pools.

### 2. *Acharadria larynx.* (Pl. XVII. figs. 7, 8.)

"Polypary branched, spirally twisted. Polyps pale orange, with two rows of tentacles. The lower row from 4 to 12, the upper row from 2 to 8 capitate."

On stones carrying *Caryophyllia Smithii*, received from Ilfracombe. This little Tubularian was about a quarter of an inch high, with three polyps, and resembled in habit *Tubularia larynx.* It bears the same relation to Vorticlava that Corymorpha does to *Tubularia larynx.*

### 3. *Zooteirea religata.*

I described this animal to the Society about three years it is an elastic tube, which appears to consist of denser tissue than either of the elements of the body. The axis of the tube is occupied along its whole length by a powerful muscular band, which is well seen in the figure (Pl. XIX. fig. 1 *d*), in which the tube is distended with water, as sometimes occurs. The animals are very sluggish, remaining for days motionless, with all their rays extended; but the moment they are touched they vanish, drawn close down by their powerful muscular apparatus into the interstices of the shells in which they are generally found. Zooteirea multiplies by gemmation. The bud, which is given off close to the stalk, separates as a minute Actinophrys, which instantly fixes itself and develops its stalk. The lower part of the stalk is included in a mass of gelatinous tissue into which the animal can entirely retract itself. The long tentacles of *Zooteirea religata* can only be properly brought into "black ground illumination," when they appear like the rays of a silvery star, slightly curving under the influence of currents in the waters.

4. *Freya* (*Lagotia*) *obstetrica*, *Freya stylifer* (n. sp., T. S. W.)

It is now some years since I described several species of the new genus Lagotia to the Society. It appears, however, that Claparede and Lachmann had already constituted the genus Freya for animals evidently belonging to my genus Lagotia, in a memoir which they communicated to the French Academy, which memoir was printed after my communication to this Society. The species of Freya discovered by them differed from any of my species, and I have now to describe two other species of this very remarkable genus. *Freya obstetrica* (Pl. XIX. fig. 4.)—" Lobes of rotatory organ very broad, not folded; the tips bluntly rounded and incurved, so as to resemble very closely the blades of the obstetric forceps. Body fusiform, scarcely longer than the rotatory lobes. Nucleus large, colourless, surrounded by dense green pigment. Body and rotatory lobes covered with striæ, bearing fringes of cilia. Cell flask-shaped, without a trumpet-shaped mouth. Colour of animal and cell pale bluish green." *Freya stylifer* (figs. 5, 6.)—" Rotatory lobes short, narrow, and widely expanded, one of the lobes bearing at its tip a fleshly prolongation or style as long as the lobe; cell tubular, without trumpet-shaped mouth; cell and animal colourless." *Freya stylifer* is the smallest species I have yet seen of the genus to which it belongs; when contracted within its tube, it projects the curious style, which is doubtless a sense organ, beyond the opening, only entirely retracting it when rudely disturbed.

During the last summer I had an opportunity of watching another species of Freya (*F. producta*) building up its remarkably constructed cell. The cell of this species, which is often immensely prolonged, is formed of a spiral ribbon of chitine, cemented by a thick internal layer of soft green sarcode, secreted by the body of the animal, so that the whole forms a hollow tubular spring, like the spiral wire tubes formerly employed for conveying gas to moveable burners. These tubes will therefore bend aside like a willow twig on any rude contact from the animals which are constantly dashing about, and will instantly regain their proper position. The young *Freya producta*, which is a free swimming larva, fixes itself, and secretes the lower part or body of the cell from the outer surface of its body; it then begins to form the elongated neck by depositing the chitine and sarcode on the upper edge of the constantly lengthening ribbon, carefully moulding the plastic materials with its two short rotatory lobes, which it uses like a pair of hands (Pl. XIX. fig. 2), just as Sabella and Serpula mould their tubes with their hand-like secreting leaflets. Having built its tube to the requisite length, it finishes it off with a handchyma of the body supporting it are drawn out into a long thin process. When the animal issues from its tube, it protrudes its ciliary organ as a fleshy column, fringed on one side by a row of very long motionless cilia, but in an instant the column is twisted into a spiral, and the cilia are set in violent motion, urging currents of water towards the mouth. The marine species approaches in character, as to its rotatory organ, to *C. Mulleri*, while it inhabits a mucous tube like that of *C. Mucicola.*

6. *Oxytricha longicaudata.* (Pl. XIX. figs. 7, 8.)

This remarkable animal, resembling very much *Oxytricha retractilis*, described by Claparede and Lachmann, was found in great numbers with *Chœtospira maritima.* The tail in this species is fully twice as long as that of *Oxytricha retractilis*, and is dragged after the swimming animal like a trailing rope, when suddenly the extremity of the tail is fixed by the long cilia at its extremity, and the Oxytricha, by violent contractions of its tail, jerks itself backwards and forwards in the most violent manner. The structure of tail, under an excellent power of eighty diameters, presents a peculiar striated and plaited appearance, like that of voluntary muscular fibre, but I could not make anything of it under higher powers.

### *Description of Plate* XVII.

Figs. 7, 8.—*Acharadria larynx.*

### *Description of Plate* XVIII.

*Zooteirea religata*, seen by black-ground illumination, and focussed for the centre of the "endosarc;" *a*, with palpocils extended and curved by an upward current of water; *b*, emerging from its cell; *c*, retracted within its cell.

### *Description of Plate* XIX.

Fig. 1.—*Zooteirea religata*, with palpocils partially extended, and tubular contractile pedicle distended by water; *a*, ectosarc; *b*, endosarc; *c*, tube; *d*, muscular band; *e*, areolar fibres; *f*, gelatinous cell.

Fig. 2.—Young *Freya producta* building its tube.

Fig. 3.—*Freya producta* with lengthened tube; *a*, old mouth of tube; *b*, thickened part of body from which the tube is secreted.

Fig. 4.—*Freya obstetrica*; *a*, nucleus.

Figs. 5, 6.—*Freya stylifer*, extended, and in its cell.

Fig. 7.—*Oxytricha longicaudata*, with tail extended.

Fig. 8.— „ „ with tail contracted.

## VI. *On peculiar Hooked Spines on* Ophiocoma bellis, *with Observations on the Spines of other* Ophiocomæ. (Plate XX.) By Chas. Wm. Peach, Esq., Wick. (Specimens and drawings were exhibited.)

On the 26th January 1859 a paper of mine was read, giving an account of the discovery of hooked spines on *Ophiocoma rosula*, of which I had seen no notice in any work on British star-fishes. In April of the same year, when in London, I called at the Museum of Geology, Jermyn Street, and on mentioning this to Professor Huxley, he at once referred me to a work in which similar spines were figured from star-fishes found in the Mediterranean—viz. Müller and Troschel's "System der Asteriden, 1842." Two species are figured and described as having jaw-like hooked spines—one at Table IX., fig. 4,—*Ophionyx armata*,—another at Table X., figs. 1 and 6—*Astrophyton verrucosum*. I only mention this work, so that any one feeling an interest in the subject may know where to refer. On the 14th June 1861, having obtained a large mass of star-fishes from the stomach of a cod, I found that about a hundred were *Ophiocoma bellis*. After carefully washing them, I placed portions under the microscope, and found that the under sides of the rays were furnished with hooked spines, like those I had before found on *Ophiocoma rosula*. They are not quite so distinct, nor so constant in form, and do not extend so far on the rays towards the disk; for about the middle, they become more and more obscure, and before reaching it are straight, short are most hooked towards the ends of the rays. There is however, a peculiar feature to be noticed in this species: although it has not the jaw-like spine, it is furnished with "two little obsolete or undeveloped spines." *Ophiocoma rosula* and *Ophiocoma bellis* have one only of these "obsolete spines"—*valves* I would rather call them—for an opening may be seen when these are raised, out of which the pinnated cirrhi are protruded. I regret exceedingly that I cannot find the drawings of *Ophiocoma rosula* where these cirrhi are shown, and which I sketched from a living specimen. I find in a specimen of *Ophiocoma Ballii* that the lowest spines on the under side of the rays are crowned with small hooks; and I have every reason to believe that most of the Ophiocoma are more or less provided with hooks, either on straight or jaw-like spines.

### DESCRIPTION OF PLATE XX.

Fig. 1.—Part of a ray of *Ophiocoma bellis*, showing spines, valves, &c.
Figs. 2, 3, 4, 5, 6, 7, 8.—Spines from various parts of the ray.
Fig. 9.—Part of a ray of *Ophiocoma granulata*, showing spines, &c.
Fig. 10.—One of the uppermost spines.
Fig. 11.—Hooked spine from the under side of the tip of a ray.

## VII. *The Geology of Moffat, Dumfriesshire.* By WILLIAM CARRUTHERS, Esq., F.L.S.

### *Lithology.*

I purpose in this paper describing the geological features of the district around Moffat, taking the village as my centre, and including all that lies within a radius of four or five miles. The district is situated in the centre of the immense Silurian tract of the south of Scotland; its predominant rocks consequently belong to the Silurian period. A red sandstone lying unconformable to them is the only other stratified rock. The superficial deposits are not numerous; they consist of boulder clay, gravel and sand, peat and shingle. A trap-dyke, which runs through the district a mile below Moffat in a south-east direction, is the only igneous rock with which I am acquainted.

### *Bibliography.*

I shall confine this bibliographical notice to works bearing distinctly on the district around Moffat. Hugh Miller has given, in a paper read to this Society in 1852, an admirable history of the Silurian rocks of the south of Scotland.

In the Old Statistical Account of the parish (1792), the Rev. Alexander Brown, the immediate successor of Dr Walker, describes the soils, and alludes to some of the economical products of the parish.

In 1775 Annandale was searched for coal by Mr Burrel, but the account of his survey remains in the possession of the county unpublished.

In 1800 the county gentlemen were anxious to obtain a geological description to accompany their excellent county map, and for this purpose applied to Robert Jameson, then a favourite student of Dr Walker's, to survey the county. He was on the eve of setting out for Germany, and consequently declined at that time to undertake what he afterwards in 1805, on a renewed application, performed. In the meantime, General Dirom prepared some sections of the county, from published data, which were engraved on the map; and the Messrs Busby, two coal-viewers from Northumberland, were engaged to survey the county. Their journal was published as a supplement to Dr Singer's "Agriculture of Dumfriesshire," 1812. It shows them to have been shrewd men, with quick eyes and sound judgments. They were not led astray of the contained fossils. He examined the shales at Hartfell Spaw, but noticed only their mineralogical appearance, and failed to observe the graptolites which abound in them. An anonymous critic, evidently acquainted with the rocks of the district, says, in a review of Dr Jameson's work, in the Literary Journal for 1806, "We know that *vegetable petrifactions* are very *common* in the greywacke slates of Dumfriesshire." The graptolites, which this unknown writer had evidently observed, remained unnoticed yet for many years. It seems scarcely possible that the keen eye of Dr Walker could have failed to see them. He says, "During my long residence at Moffat I collected, in a number of short tours, all the remarkable minerals of Dumfriesshire." We cannot now ascertain to what extent the structure and peculiarities of the district had been determined by him, because of the unfortunate loss of all his papers. It was not till the year 1850 that Harkness, Sedgwick, Murchison, and others, again drew attention to the rocks of the district, and re-discovered the forgotten "vegetable petrifactions." In the interval much had been done to determine the structure and position of the rocks of the south of Scotland, by Maclaren, Nicol, and Sedgwick. Professor Harkness, in his valuable and interesting papers published in the "Geological Journal," 1851, refers the rocks of the district to the Caradoc sandstone, from the characters of the graptolites. He describes in detail the anthracitic shales. An examination of their various localities led him to the conclusion that there was an anticlinal axis at Dryfe Water, that the strata north of this dipped northwards, and those south dipped southwards, and that the frequent recurrence of the graptolitic shales was produced by three faults—the various localities grouping themselves, as he supposed, into three series. Sir R. Murchison, while travelling from Dumfries to Moffat in the same year, supposed that the axis existed to the north of the former town, and published this opinion in his "Siluria," 1854, considering it identical with that of Harkness, and using one of that gentleman's diagrams to illustrate his views.

This is the generally received theory of the structure of the districts.

### *Silurian Rocks.*

The Silurian rocks in this district are remarkably similar in their composition and structure. There are no alternations of limestones, sandstones, shales, &c., as in the newer formations, or even in the Silurians of some other districts. The rocks are almost entirely composed of water-worn quartz grains and clay. These materials have been deposited either as mud, or as sand of different degrees of fineness, or of a mixture of both, and have produced shales or sandstones, which are extremely indurated, from the long continued metamorphic action to which they have been subjected. The argillaceous sandstone or *greywacke rock* is the predominant rock. It is generally fine grained, and of a uniform greyish colour, breaking with an uneven and somewhat conchoidal fracture. The beds in which it occurs are generally of considerable thickness, though occasionally it is met with in thin layers, as at the Common Craig, where it has for long been quarried as a building stone. It forms a beautiful and very durable building material. A large portion of Moffat is built of it. The *shales* are generally light coloured, but in some places they are more or less blackened by anthracite, derived originally either from the animal bodies whose remains abound in these shales, or more probably from the sea-weeds that were their companions in the Silurian seas, and which, from their soft cellular structure, have left no definite traces behind them on the rocks. Iron pyrites, aggregated in small nodules, or cream-coloured shales have been quarried for roofing slates at the head of Corrieferan Glen. They exfoliate in the planes of stratification, and have no true slaty cleavage. They are thick and heavy; and though very durable, the bad roads, and the working expenses of a quarry in such a locality, have caused them to be neglected.

The general directions of the strike of the Silurian strata is east and west; and the dip, when not vertical, is always at a very high angle—70° or more. Professor Nicol has noticed in Peeblesshire what may be observed in this district also, that the direction of the dip is towards the interior of the mountain chains, being south on the north, and north on the south side. The few scattered records of the strike and dip of the Silurian strata of the south of Scotland seem to be insufficient to establish a satisfactory theory of their structure. This will follow only after the observing and recording on a good map a large series of observations throughout the country from St Abb's Head to Portpatrick, and from the Pentlands to the Solway. The theory of Professor Harkness, adopted by Sir Roderick Murchison, does not seem to meet the facts. Many of the additional localities for graptolitic shales, discovered within the last ten years, do not fit into his three faults. Nor does it seem possible that strata, vertical, or so highly inclined, could repeat themselves in a series of faults. Faults cannot *tell*, except on more or less horizontal strata. It is more in accordance with my own observations and those recorded by others, to believe that the position of the strata is owing to enormous flexures produced in a manner similar, but not so regularly, to what has been observed and ably expounded by the Professors Rogers as occurring in the Appalachian Mountains.

### *Permian Sandstone.*

The red sandstone is a very friable rock, the quartz granules of which are held together by a ferruginous cement. Its structure is frequently very coarse, forming a sandstone conglomerate, containing numerous generally angular fragments of the Silurian rocks. At Newton it has a fine and uniform grain. A few years ago a large quantity was quarried at this place for building, but it was so friable that it could not anything satisfactory could be determined. The examination of the district, however, shows that the conclusion of Dr Singer, though correct theoretically, is really incorrect; for it is evident at the various junctions of the formations, as in the Newton, Hartfell, or Frenchland Burns, that the unconformable sandstone rests immediately on the upturned edges of the Silurian strata.

The occurrence of the black, coal-looking, anthracitic Silurian shales in many localities, has led to the belief that coal existed in their neighbourhood, and has caused several abortive attempts to reach it to be made, in opposition to the published opinions of the Busbys, Jameson, and Singer. It is remarkable that landed proprietors in every Silurian region have been induced to spend their money in vain attempts at searching for coal, where these anthracitic shales occur, on the recommendation of empirics, and generally in opposition to the published or known testimony of scientific men.

### *The Trap Dyke.*

The Trap Dyke has been quarried for some years at a point where it projects on the surface near the summit of the Lochhouse Hill. It supplies the bluish stone which has been extensively used in the recent buildings in Moffat. Its relation to the strata, through which it is intruded, can be best seen in the bed of the Evan, a little above Longbedholm Cottage. Its direction is N.W. by S.E. Beyond the point where it crosses the Evan, it may be traced in a N.W. direction until it crosses the line of the Caledonian Railway. In the opposite direction it has been quarried on Evan road side. It pushes out into considerable prominences in several places on the Coates Hill. It is also quarried, as has been said, on the Lochhouse Hill, and again in a plantation on the farm of Woodhead. Mr David Stewart has observed quarries in it in Dryfesdale and Eskdale. I believe it to be the same dyke that occurs again at Langholm.

It is a compact, fine-grained greenstone, distinctly crystalline in the centre, and becoming compact and amorphous at the edges. It is 32 feet wide at the quarry on the Evan road.

It is difficult to determine positively the age of this dyke from the strata in this district. If the position of the sandstone on the sides of the Coates Hill tells, as it seems to do, that this hill was elevated subsequently to the majority of the hills around, then this trap dyke must be either a contemporaneous or subsequent intrusion.

### *The Boulder Clay.*

The boulder clay is a light-coloured clay, containing small boulders, many of them having the rubbed and polished appearance peculiar to and common in this deposit. It covers the Gallows Hill. The only section of it that I have seen is in a gully in a narrow plantation running down from the Old Well road; but this is of no great depth. It is exposed in the Whins, where it is sometimes dug for use in the village. The shoulder of land between Moffat and Annan Waters, forming Aikrigg farm, seems to consist also of boulder clay. A few of the large boulders here lying on the surface are from the Trap Dyke, which passes through the fields in this locality, although it cannot be detected on the surface.

*Gravel*, here and there intermingled with sand, occupies the bottom of the valleys. At Granton, on the Dykefarm and in other localities, it exists in considerable masses. It presents no peculiarities requiring particular notice.

The sides of the hills are covered with angular shivers—fragments of the underlying rocks—mixed with soil.

*Wednesday, 23d April* 1862.—JAMES M'BAIN, M.D., President, in the Chair.

The following gentlemen were elected members of the Society:—

Peter Waddell, Esq., Claremont Park, Leith; James Crichton Browne, M.D., Dumfries.

Committees were appointed for special investigation during the summer.

The following Donations to the Library were laid on the table, and thanks voted to the donors:—

1. Bibliographia Librorum Entomologicorum in America Boreali editorum. Auctore Guil. Sharswood.—From the Author. 2. Jahrbuch der Kaiserlich Königlichen Geologischen Reichsanstalt 1860. XI. Jahrgang, Nro. 2. April-December. Wein.—From the Imperial Geological Society of Vienna. 3. Report of the Commissioner of Patents for the year 1858. Agriculture. Washington, 1859. 4. Report of the Commissioner of Patents for the year 1857. Agriculture. Washington, 1858.—From United States Patent Office.

The Communications read were the following:—

### I. *Observations on the* Phocidæ *of the Greenland Seas.* By JOHN WALLACE, M.D. Edin. (Communicated by ROBERT BROWN, Esq.)

In this memoir, Dr Wallace described minutely the characters of the four species of seals which form the source of the fisheries in the Arctic seas, and entered at length into an account of their habits and history—a subject regarding which little or nothing is known, and that (from the remote and almost inaccessible regions which the animals frequent) in a very contradictory and confused state. He prefaced his observations on the species with some general remarks on the anatomy and physiology of the group. The length of the intestine, according to his measurement, varies between fifty and sixty feet. The livers have no poisonous properties, as has been alleged regarding those of Nova Zembla and the Southern seas. (*Anson.*)

In the young seals the lymphatics of the neck are subject to a disease, which appears to be analogous to, if not indeed true scrofula.

Many theories have been adduced to account for their capability of remaining so long below the surface of the water with impunity, though that of Buffon and the physiologists of his time, and of Blumenbach and Houston in more modern times, are the most celebrated. The first is untenable, as Dr Wallace found the *foramen ovale* unclosed in only one of the many hearts which he examined; and in regard to the venous sinuses said to have been found by the latter anatomists in the liver and neighbouring parts, he had seen nothing which deserved the name. The venous system on the whole, and not in any particular part, unless in the *vena cava*, from the pressure exerted on its walls, is greatly enlarged, but this arises from the great quantity of blood these animals possess. Moreover, supposing these sinuses to exist, they could not contain the full quantity of blood that may return in that period from the capillary system. Their power of remaining so long below the water is to be referred to a cause physiological, and not structural.

Their expertness in swimming is not acquired from birth, but only as an innate instinct. On first taking the water, they swim about in the smooth pools among the ice, and then swimming slowly and quietly about, seldom remaining longer than a few minutes below the surface. This training, coupled with the enormous quantity of blood which they contain, and their slow respiration, will account for their capability of enduring *pro tempore* a sub-aquatic life.

1. *Phoca Groenlandica*, Mull. (The "Saddleback" of the northern sealers.)

The most common length is five feet and a-half. The bluish colour on the back, while on the breast and belly it is of a dark silvery hue.

Young seals retain this appearance throughout the summer, and are termed "blue-backs." The next and last stage is into the mature coats of the male and female adult. Three summers will be nearly the time required for these changes. The "saddleback" has a wide distribution, influenced greatly by the nature and distribution of the ice, and performs a migration north in the spring, and south in the winter. Dr Wallace gave numerous additional details regarding its natural history, from personal observations in the Greenland seas during the year 1860.

**2. *Phoca leonina*, O. Fab. (The "Bladdernose" of the English sealers.)**

No sealers, as far as he was aware, had ever seen such a seal as that described by Otho Fabricius in his "Fauna Grænlandica," viz., with a straight line of brown on its back, as that author describes this seal in its second year. Crantz and Fabricius disagree regarding the localities which it frequents; the one affirming that it is found mostly on great ice islands, where it sleeps in an unguarded manner, while the other states that it delights in the high seas, visiting the land in April, May, and June. Both authors are correct, though not in any exclusive sense. The "Bladdernose" is found all over the Greenland seas from Iceland to Spitzbergen and Nova Zembla.

**3. *Phoca hispida*, Mull. (*Phoca fœtida*, O. Fab. *Netsik* of Greenlanders.)**

The smallest seal in the Greenland sea. It is chiefly seen, and taken as a curiosity, by the whalers, who call it the "Floe-rat," as it is always found on floes of ice, or quietly swimming about in the floe waters.

They appear to be confined to high latitudes, and especially to the parallels of 76° and 77° north latitude in the Greenland and Spitzbergen seas, and it is in those latitudes that the whalers find them.

4. Dr Wallace described a fourth species of seal, which forms a considerable source of the Greenland seal fishery,

and which he considered corresponded more closely to Crantz's description of the Eskimo *Atarsoak* than *P. Greenlandica*, to which it has been referred; otherwise he believed that it was unknown to science.

It is the "Ground-seal" of the hunters, and, like the last noticed species, few are taken by the sealers, but are mostly seen by the whalers in high latitudes, especially from the parallel of 76° north latitude as far as Spitzbergen. The length of the male is about eight feet, and the female upwards of six feet. The colour and peculiar markings of the male very much resemble the male Saddleback, but its appearance is much more robust, and of greater girth for its length; while, upon the whole, the shade of its colour is darker, and yellowish or coppery ground colour more distinct. The full-grown female, also, to a certain extent, corresponds to the female "Saddleback;" with this marked difference, that her colour is of a deep tawny yellow. Lepechin's *Phoca leporina* of the White Sea, or "Hare of the Sea" of the Russians, is almost identical with the female ground-seal. Its most common resort is on the floe and fixed ice—in herds of two or three hundred.

Shannon Isle and the east coast of Greenland are said to be peculiar haunts of this species, in common with the "Bladdernose." Its habits differ much from those of any other species of seal at present known to naturalists.

Dr Wallace concluded his paper with some general reventing the congelation into ice, or breaking it as soon as formed. It is impossible for the seal to pierce the ice after being formed to any thickness, as has been theoretically alleged, by keeping its warm (?) nose to the ice, thus melting out the hole. Unfortunately for this hypothesis, the nose is quite cold; but even allowing the temperature of the muzzle capable of performing this feat, where could the animal rise to breathe during the process? It would not venture to break through by force, as the nose is proverbially the seal's mortal point. Their fondness for music is taken advantage of by the hunters, to the destruction of the listeners. Many wonderful stories are told regarding the affection which they bear to their young, and, with the exception of the "Bladdernose," they appear to have little or no combativeness in their nature. In the Greenland sea, the "Mountebank shrimp," *Gamarus arcticus*, forms the staple food of the seals.

The number of seals taken yearly by the British and Continental ships (principally Scotch, Norse, Dutch, and German), in the Greenland seas, when they get among them, will average upwards of 200,000, the great bulk of which are young "Saddlebacks." When they have arrived at their maximum quality, 80 will yield a ton of oil; otherwise the general average is 100 to the ton. In 1859, good oil sold at about L.33 per ton; add to this the value of 100 skins at 5s. each, and the whole will amount to L.58 sterling.

From this simple calculation, a very good estimate may be formed of the commercial value of the Greenland seal fishery; for, supposing 2000 tons of oil to be about the annual produce, and assuming L.58 as the value per ton, inclusive of the skins, the whole produce of the fishery will amount yearly to L.116,000 sterling.

There seems little doubt, notwithstanding the additional protection which the northern seals receive from the ice, that, before many years have elapsed, the seal fisheries in Greenland must share the fate of those in other parts of the world, and become extinct as a source of commercial value.

The sealing fleet meets about the end of February in

Bressa Sound, off Lerwick, Zetland, from the British ports. It leaves for the north about the beginning of March, and shortly afterwards commences to encounter the ice. Upon the whole, the trade is a most dangerous and precarious one, and in many years does not repay the money expended on it.

### II. *Notice of a Mass of Meteoric Iron, found in the Village of Newstead, Roxburghshire; with some General Remarks on Meteorites.*

By JOHN ALEXANDER SMITH, M.D. (Plate XXI.)

*Description of Mass of Iron.*—The external surface of this mass of iron (exhibited to the meeting) is rough and irregular; and it affects the magnetic needle very strongly.

Its shape and general appearance is rather elegant, consisting principally of a large rounded and lobulated mass, irregular in outline, which tapers rapidly at one end to a four-sided pyramidal extremity, and terminates in an obliquely truncated point. (See Plate XXI.)

For the purpose of a detailed description of its form, it may be divided into two portions: the larger extremity, which is rounded in its character; and the smaller, flattened, and smoother on its surface, which tapers to a blunt point. The first, or larger portion, is formed of a clustering mass of rounded lobes irregularly grouped together, and terminates behind in a broad blunt edge. The lobes vary in size, and in their greater or less projection from its surface. A deep furrow runs obliquely round the whole mass, and in front of measure each about 2½ inches in length; and one of these sides (showing a dimpled outline), from the oblique position of this lozenge-shaped extremity to the general mass of the meteorite, forms its small terminal edge, or pointed extremity.

The whole shape of this piece of meteoric iron suggests the idea, that when its fall took place, the extremity, now the smaller and more pointed, first reached the earth, which, from its resistance, crushed the glowing and softened mass into these peculiarly flattened surfaces of its pyramidal extremity, bending even the oblique point itself a little upwards and backwards; while the larger extremity, though slightly flattened below, where it struck the ground, still shows in the projecting masses of its upper surface, the part least affected by the shock of its terrible descent through our atmosphere, to bury itself in *terra firma.*

*Size.*—The mass of iron measures 10¾ inches in its greatest length, and 7 inches across the widest part, about the middle of its length; the larger blunt-edged extremity measuring 6 inches across. Its circumference round the larger extremity is 1 foot 3 inches; round the large lobular projection (about the middle of the mass) its widest part, 1 foot 8½ inches; while within 1½ inches of the point, it measures only 9½ inches in circumference.

*Weight.*—It weighed 32 lbs. 11 ounces 1½ drachms avoirdupois, equal to 39·60 lbs. troy.

*Specific Gravity.*—The specific gravity of the entire mass, Dr Murray Thomson informs me, is 6·517.

*Colour.*—The external surface of this meteoric iron is of a dark reddish brown, approaching in some parts to black; and the lobulated parts show here and there, especially in the furrows which divide them, spots of a brighter red colour, due apparently to the partial oxidation of its surface.

*Photographs.*—The general appearance of the meteorite is well shown in the photographs exhibited. These have been beautifully taken by Mr Alexander M'Coll. The mass of metal was laid on the 8vo vol. of the Royal Physical Society's Proceedings, which thus gives a correct idea of its relative size and proportions; and, when the second picture was taken, the volume was turned quite round, without touching the iron; and in this way an exact representation of both its sides was obtained. From one of these photographs the accompanying Plate of the meteorite is taken.

*Plaster Casts.*—For the purpose of preserving completely the original appearance of the meteorite, a mould was carefully taken before it was sent to the lapidary to be cut. This has been very successfully done, as shown by the casts* exhibited, coloured after the original.

*Rarity.*—This mass of meteoric iron is the largest that has yet been discovered in Great Britain; only *one* other indeed, is known, a very small one—about the size of a hazel-nut. Robert Philips Greg, Esq., of Manchester, in his recently published valuable work,† and in letters with which he has favoured me, states that this small mass of meteoric iron "was found a good many years back by Da Costa, at Leadhills, and is now in Mr Greg's collection." It has since been secured for the national collection, the British Museum. Mr Greg tells us the proportion of meteoric stone to iron falls may be taken at 25 to 1,—*i. e.*, 96 per cent. of all that fall consist of stony matter; and in his Mineralogy he gives a list of nineteen or twenty meteoric *stones*, the fall of which has been recorded, as occurring in Great Britain and Ireland. The instance above referred to is, however, the only one of meteoric *iron* previously known and recorded. In the neighbouring country of France one specimen has been observed; and Mr Greg gives twenty-seven hood when various relics of the Roman occupation, discovered here, were presented to the Museum of the Society of Antiquaries of Scotland, I shall now simply point out the exact locality where this mass of meteoric iron was discovered. Like other Scottish villages which have not been interfered with in their formation by the over-ruling taste of some adjoining great landowner, the dwellings of the little proprietors or feuars have been scattered over the ground as their own fancy or convenience dictated,—keeping, however, in a general way by the lines of the roads which intersect the village, and clustering especially along the principal highway which passes through, running east and west, from Drygrange Bridge towards Melrose. On the south side of this last mentioned road, and near the eastern termination of the village, there is a group of three cottages, beyond which a narrow cross road turns southwards into the valley behind, past one of the village wells, and crosses the little streamlet which runs at the bottom of the cottage gardens.

In the year 1827, Mrs Kate Williamson or Davidson, the proprietor of the third cottage from the cross road just referred to, commenced to build another small cottage along the western border of her garden, to which there was access past the open end of her house, forming as it did the farthest west of the little group of cottages. The house was to be erected behind the other cottages and at right angles to them, and, to save the garden ground as much as possible, it was to be placed along its boundary. The garden was enclosed by a broad mound of earth or old turf wall with some stones intermixed; this, of course, had to be removed, and the ground brought somewhat to a level surface before the foundations of the house could be dug; these were then cut out of the firm undisturbed clay below, and the building operations commenced. Mrs Davidson had her own peculiar ideas of what were to be the special conveniences of her new cottage, and, accordingly, she caused two small pits or cellars to be dug in the floor of the kitchen, at no great distance from the back wall and fireplace, which were to be covered over with wooden lids or doors, and in them coals or other necessary articles were intended to be kept. Cu enough, it was in the process of digging out one of these sunken cellars that the black extremity of this piece of meteoric iron was noticed sticking in the clay, at a depth of some three or four feet from the floor of the house. These pits were dug out of the ground, close by the boundary of the garden, on that part of it formerly covered by the broad mound of earth, or old turf wall, which formed the original fence. (The site of this house is well seen in the Ordnance Survey Map of the village, in the small division No. 2211.)

The unusual appearance and great weight of the black-looking stone attracted the attention of Mr George Burnet, one of the masons employed at the work; and as he had a taste for collecting anything peculiar, he carried it to his own cottage, which was only a few doors farther down the village. Mr George Burnet died in 1842, and Francis his brother succeeded to the cottage and garden, which he still occupies. Some time after a stone wall was built round this cottage garden, and as specimens of different kinds had been collected, an old stone trough, which happened to be in the way, was laid on its side and built into the wall, forming thus a sunk recess, where those various specimens which were considered scarcely ornamental enough to be kept in the dwelling house, could be placed in safety; and here this mass of meteoric iron has lain, for five-and-thirty years; exhibited from time to time, with the other curiosities, to any chance visitor whose fancy might lead him to examine them.

Francis Burnet is an intelligent, observing man, and to him I was formerly indebted for collecting some of the Roman relics which were found in the neighbouring fields. When residing in the district last summer, I visited the village, to learn if anything new, or rather old, had been observed in the course of the agricultural operations of the last few years; and my attention was soon attracted to the small collection of specimens in Mr Burnet's garden. I was at once struck with the very peculiar appearance of this mass of metal, which we removed to the burn side at the foot of the garden, to get washed and inspected more carefully. I then learned the history of its discovery, already so minutely detailed, and afterwards inspected the locality itself, being anxious to collect and put on record all the incidents relating to this specimen, which I was inclined to think might turn out to be a mass of Meteoric Iron. A hammer was got, and one of its corners was slightly abraded; this showed the pure metal of which it seemed to be composed; and its great weight, as compared with its size, proved that it must consist almost entirely of metal; it was therefore no ore of iron. While its peculiar shape was totally unlike that of any kind of manufactured metal—for its hardness, and closeness of grain, suggested that it resembled hammered iron, or steel; the district however, was no iron-producing one, and forges of greater size than that of the village blacksmith were quite unknown, and its history pointed to a period probably long before historic times. I was therefore convinced the specimen was native iron; and from the very great rarity of this metal in any quantity, and the fact of its being found buried in the clay bank, there appeared to be little doubt it was of meteoric origin. Stating my conclusions to Mr Burnet, and my anxiety to get possession of the iron for a more careful and decisive examination, he kindly agreed to let me have it for this purpose. Accordingly, it was arranged it should be immediately forwarded to my residence, that I might take it with me on my return to Edinburgh, for a complete determination of its true character and peculiarities. On mentioning to Mr Burnet my astonishment that no person had ever called attention to this very singular-looking piece of metal, the true character of which had been so long overlooked, I was informed that, some three or four years before, the Rev. Dr Rogers of Stirling, when on a visit to Newstead in search of Roman remains, among other things had examined it, and seemed to take a somewhat similar view to mine of its origin; but nothing having been said or done to settle the apparently very doubtful question, Mr Burnet had thought no more about the matter.

On bringing the mass to Edinburgh, it was shown to various friends, who at once agreed with me there was little doubt of its meteoric character. With Mr Alexander Bryson and Dr M'Bain's kind assistance, an abrasion was made on its surface, and the nitric acid test applied, when a slight appearance of the peculiar and characteristic etching became manifest; a little of the metal was then filed off, and put into the hands of Dr Murray Thomson, lecturer on Chemistry, without letting him know its history, and he informed me the filings consisted of iron, with a proportion of nickel. Native iron of terrestrial origin being almost chemically pure, and never containing any proportion of nickel, the mass of iron was therefore of meteoric origin, being an alloy of iron and nickel; the latter generally existing in very small proportion to the former.

The peculiar shape and appearance of this mass of metal itself, so entirely unlike any handiwork of man, was indeed almost proof enough to many of its meteoric character, of which, however, there was now no room for doubt.

The subsequent steps taken to learn the special peculiarities of its structure and chemical analysis have now to be detailed.

*Section of Meteoric Iron.*—The iron was cut longitudinally into two portions, by Mr Young, lapidary, as I was anxious to see whether any difference of structure existed in any part of the mass, or whether cavities containing olivine could be detected. Nothing of this kind, however, was disclosed, the mass being equally solid, dense, and steel-like in its appearance throughout, and the colour beautifully bright and white, like steel. With Mr Alexander Bryson's assistance, and a new steel file, I next proceeded to rub down as much of the surface of one of the pieces, as would suffice for a minutely detailed chemical analysis being made; and in its longest diameter. Its hardness, as shown by a graving tool, was greatest next its outer surface—the inner portions being apparently softer, and more open in texture, while the prism-like point was tougher before the tool, and more like hammered iron ; the explanation probably being—that this peculiarity was due to the shock of the fall being given principally to this part of the mass ; and also, to its being suddenly cooled by the contact of its surface with the earth in which it was found buried.

The filings, of which about a troy ounce were procured, were black, and showed little of the shining metallic appearance of pure iron.

*Chemical Analysis.*—The filings were sent for examination to Dr Murray Thomson, who gives details of their composition in his subsequent communication. (See Analysis of Meteorolite, by Dr Murray Thomson.)

*Test of Etching by Acid.*—Each portion of the iron has been partially etched with the acid used by engravers on steel, which consists of equal parts of nitric and acetic acids ; and the etched surfaces show the rough, irregular, projecting lines of the crystalline structure of the mass, which have been apparently but slightly acted on by the acid, from the presence of nickel ; the dark lines and spaces showing where the acid has acted with greater effect. The acid was applied in the usual way for etching, and appeared to bite all at once, and that pretty deeply ; it was then removed, the surface of the metal washed, and the acid reapplied, when it acted very slightly, and soon ceased to act altogether, not biting any deeper into the surface of the metal. The rough etched surface is characteristic of meteoric iron, various bright lines or points being observed in the fine frosted like appearance of the crystalline or fibrous surface of the metal. This etched surface is finer and more minute in its texture than that of any meteoric irons, the etchings of which I have been able to examine, suggesting a more minute subdivision of the particles of the iron and nickel, and a more general mixture of the nickel through the mass.*

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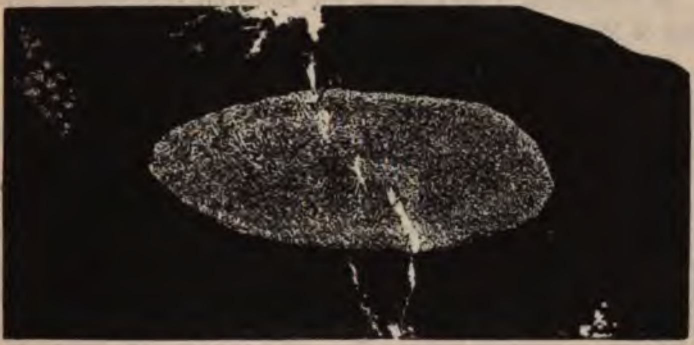
* Mr R. P. Greg of Manchester informs me this minute texture resembles the structure of the iron also found in Britain, and described by him,—more

tially surrounded the mass, that this furrow had penetrated much deeper than was suspected, and that the few scattered dark spots, like corrosions on the polished surface of the sections, were the termination of the inner portions of this very furrow, part of the decay of which might be caused by the exposure and weathering the mass had undergone, in the five-and-thirty years of its existence on the surface of the earth; the origin of the furrow being due to the lobulated arrangement of the mass.



Impression of Etched Surface of the Meteoric Iron.

*Weight and Specific Gravity of each of the Sections of the Meteorite.*—Dr Murray Thomson has furnished me with the following notes of the weight and specific gravity of the different portions into which the meteorite is now divided:—

"I. Of the halves into which the iron was cut, one was rather larger and heavier than the other, and weighs:—

In air, 18 lbs. 2 oz. 7½ drs. (Avoir.)
In water, 15 „ 5 „ 12½ „ „
Its specific gravity is therefore . . 6·499

"II. The smaller half, now broken into two portions, weighs:—

1. The larger or pointed portion,
In air, 7 lbs. 9 oz. 8½ drs. (Avoir.)
In water, 6 „ 7 „ 8 „ „
Specific gravity, . . . 6·7400

2. The smaller rounded or lobed portion,

In air, 5 lbs. 10 oz. 2½ drs. (Avoir.)
In water, 4 „ 11 „ 9½ „ „
Specific gravity, . . . 6·1919"

The difference in the specific gravity of the halves of the meteorite may probably be explained, by the presence, in the smaller portion of the mass, of the principal part of the large furrow already referred to—filled up with earthy-looking matter* of lighter specific gravity.

In conclusion, I may add a few notes on the general subject of Meteorites or Aërolites.

*Theories of the Source or Origin of Meteorites.*—Various theories have been at different times brought forward to account for the presence of meteorites or aërolites, these strange and apparently accidental visitors.

These theories may be arranged in two great divisions:—

*First,* The terrestrial sources—the source or origin of these bodies being supposed to belong to our earth; and, *secondly,* The cosmical sources, which derive their origin from beyond our earth. These again may be each subdivided into two sections, or classes, as follows:—

I. TERRESTRIAL SOURCES.

1. *Volcanic*—from the volcanoes of the earth.
2. *Atmospheric*—from their supposed formation in the atmosphere of our earth.

the earth's orbit, being now generally considered as the view which meets and explains most easily the peculiarities of their structure and appearance. For expositions of some of the various theories on these subjects, I need only refer to the well-known memoirs of Professors C. U. Shepard and J. L. Smith, M.D., of America,* and especially of Mr Robert Philips Greg,† of Manchester. M. Haidinger, director-general of the Geological Survey of Austria, has also published his views on the origin of aërolites, in a recent communication to the French Academy of Science.

*Catalogues of Meteors and Meteorolites.*—Catalogues detailing the particulars of all known meteors, aërolites, &c., have been from time to time published. I may refer to those given in the Reports of the British Association, and to the very complete list by Mr R. P. Greg in the Report of the year 1860.

Aërolites may be supposed to have fallen on our earth from the earliest periods of its history. I am not aware, however, of any instances that have been noticed connecting their existence with the earlier or geologic history of our globe. In the sacred Scriptures, such expressions as the *great stones*, and the hailstones, that were cast down from heaven, on the enemies of Israel, on the memorable occasion when an apparent interruption of the earth's motion took place (Joshua x. 11); and, again, the use of such terms, as *coals of fire*, in addition to the lightning, by the Psalmist, when speaking of the wonders of the Almighty (Ps. xviii. 12, 13), suggest, at least, the possibility of an allusion to these mysterious bodies at that early period.

*Meteoric Stones worshipped.*—In the book of Acts (xix. 35) we have reference made to the image of the Diana of Ephesus, which fell down from Jupiter, undoubtedly an aërolite. The fall of one of these bodies among an ignorant and superstitious people, with its attendant phenomena of fire and explosion, would naturally be considered as a message from the gods, and especially from the presiding deity of the district. Various instances of falls of this kind are noticed by ancient authors, whose statements we have no reason altogether to disbelieve. We have also instances of the fall of aërolites recorded in our own day, being followed by similar results, as in a case noticed by the Rev. Baden Powell, M.A., &c., in his Report on Meteors to the British Association in 1850; of a stone-fall at Durala, near Loodianah, in 1815, when the natives worshipped it, and commenced subscriptions for erecting a temple over it. Two stones fell at Parnallee, near Madras, in 1857: and their fall was followed by exactly the same results—crowds of natives worshipping the larger stone, "as the image of their deity, which had fallen from heaven" (see Silliman's American Journal of Science, No. 32, Nov. 1861). One of these stones weighs 130 lbs., and is the largest meteoric stone known: it is now, I am glad to say, deposited in the British Museum.

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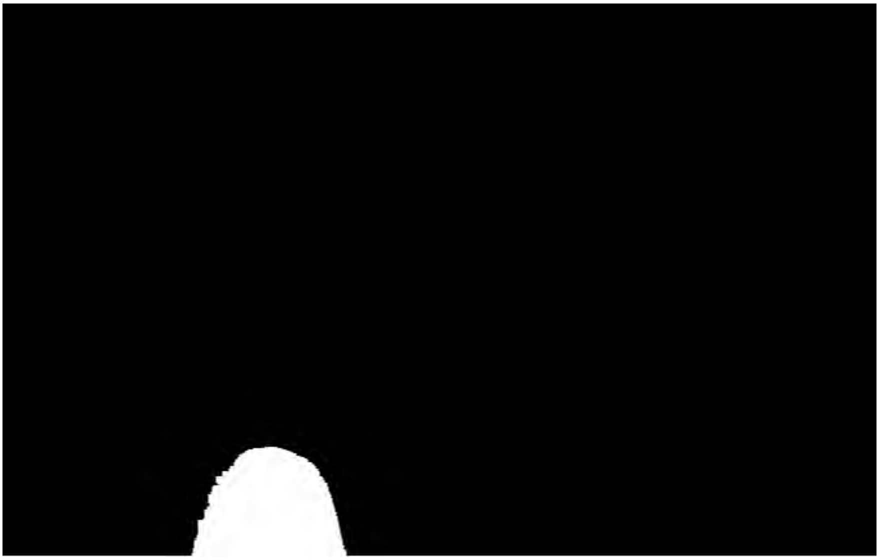
* American Journal of Science.

† Essay on Meteorites.

There seems little doubt that meteoric falls were one, at least, of the causes of the stone-worship of the ancients, instances of which are represented on their coins, under canopies or shrines. The Diana of Ephesus is not represented in this way, although on an ancient medallion given as an illustration to a learned paper on the Coins of Ephesus,* by Mr J. Y. Akerman, and struck, he supposes, for those who came to wonder and to worship at her shrine, there is a rude mummy-like figure of the goddess, and on its head, if not simply an imperfect *modius*, with which she is often represented, something which reminds one of the very distinctive shape of a meteoric stone or aërolite.



the question of the distribution of aërolites. Had we such a map, we could judge at a glance whether meteoric falls were generally pretty uniform in their distribution over the earth, according to Mr Greg; or whether there are any signs of the local aggregation of these bodies in particular districts, as in the two so-called meteoric zones of Professor Shepard.

*Have Meteoric Falls any relation to Terrestrial Magnetism?*—We already possess maps, giving us the rain-fall over the world; and what a pleasure it is, when studying them, to be able to turn to other maps of allied phenomena, as, for example, the map of the winds, and to see at once how these different agencies act and react upon each other, and how the one map helps to explain to us the other. If we had our map of the aërolite falls, could we turn to any other map in our physical atlas that would help us to understand them any better? I cannot tell—but would be greatly interested in examining and comparing with it the maps illustrating the difficult subject of our terrestrial magnetism, and would be anxious to see whether the one threw any light, or appearance of light, at all on the other. To enable me the better to judge of this, I would carefully distinguish all *metallic* from *earthy* meteoric falls, and would be curious to observe whether the apparently irregular scattering of the former over the world could be seen to bear any particular relation to the various centres of greater magnetic force.

There are four poles or maxima of magnetic attraction known to exist in our earth, a stronger and a weaker, in the northern hemisphere; and also a stronger and a weaker pole in the southern hemisphere. Supposing I have correctly stated these views of our terrestrial magnetism, it does seem interesting to find an observer like Professor Shepard coming to the conclusion, from entirely different data, of the existence of the two meteoric zones, which at once attract me, by their position appearing to bear some relation to these northern poles of magnetic force. He tells us, he finds the meteoric zone of the old continent rather strangely translated farther to the north than that of the American continent; this seems also to show a relation between terrestrial magnetism and these meteoric falls, as it is stated that the northern pole of magnetic force of the Old World (the weaker of the two), lies a good many degrees farther north than that of the New World.

Another fact, which is rather a puzzling one, is the very great relative proportion of *metallic* falls which have been discovered in America, as compared with any other part of the known world—thirty-two meteoric irons having been found in the United States, according to Professor Shepard, twenty-three of which are included in his meteoric zone. While only fourteen meteoric irons (whose time of fall is unknown) have been recorded as found in the Old World, and eleven of these falls are included in its so-called meteoric zone.* Mr Greg gives the number of localities of meteoric irons in the Western Hemisphere as fifty-seven; those of the Eastern Hemisphere being twenty-seven.† Various explanations have been given of these facts; it is rather curious, however, to observe, that in the New World, we have the greatest number of metallic falls, apparently in the neighbourhood of the very locality where the magnetic force is described as being in a maximum in the northern hemisphere. The metallic falls of the Old World seem also to bear a relation to the other northern magnetic pole; though, from its force of attraction being relatively weaker, it may be, the number of these metallic aërolites here is less, and the concentration of them together would also appear to be less; the meteorites straggling, in their deposition, to greater distances still these are only minor influences, the great magnetic force of the earth being situated exclusively in itself. Now, in my ignorance mayhap of the question, it does not seem to me to be a thing past belief, that when the earth in its orbit comes into the neighbourhood of the region in which these aërolites are now believed to exist; and, when their occasional proximity is close enough to bring the attractive powers of the earth—the greater mass, to overbear that of the smaller—the aërolite ; besides, the mere attractive force of gravity dragging it down to the earth, that mysterious agency, the earth's magnetic attraction, should also come into operation; and, that a greater influence should of course be exerted over those bodies which are purely metallic, the component parts of which being also magnetic, are all strongly acted on by this magnetic influence ; so that, as the daily revolution of our world takes place, the metallic meteoric falls would especially occur, as near as possible, to the poles of the greatest magnetic force ; or at least as near as would be compatible with the power of the other forces which might assist in attracting them to the surface of the earth. The possible, shall I say probable, result being, that *metallic* meteorites, other things being equal, would be found clustering in greatest numbers near the points of the earth's greatest magnetic force, at the time of their fall ; and, the stony meteorites, attracted magnetically in a less degree, would, from the more general causes of their attraction, be spread more abroad over the general surface of the globe.

Of course the poles or points where the magnetic force is in a maximum state, in the southern hemisphere, would also have their share of these metallic masses ; but with these regions we are comparatively unacquainted, and must not forget the greater presence of water—the sea—in this part of the world, which hides at once any meteoric fall that might take place on its surface. Metallic meteorites, however, are not altogether unknown in Australia, two very large masses* having recently been discovered within some twenty miles of Melbourne. A friend of mine, just returned from Melbourne, tells me he has seen portions of them, and they somewhat resemble the piece of iron I have exhibited.

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* One at least of these masses has been lately secured for the British Museum.

Whether there may be any truth in these theories or not, I cannot determine; only they make me the more anxious that we should be possessed of a map of reference of these strange phenomena, and I hope our townsman, Mr Alexander Keith Johnston, will be good enough to give my idea of a map of the "Distribution of Meteorites over the Surface of the Earth"* his favourable consideration, when preparing for publication a new edition of his valuable national work, the "Atlas of Physical Phenomena."

Since this paper was read, the half of the Meteorite, which was broken into two portions, has been cut into several sections or slices, and in the process of doing so, it was found that the thicker or rounded portion was very hard and dense, resembling cast-iron in its character; it was harder than untempered steel of the best quality, but not so hard as the prepared steel plate of the engraver; while the pointed portion was softer and tougher, and was found to resemble iron to which a small portion of malleable iron had been added. The slices showed that the mass was dense and metallic throughout, with the exception of a small part of the pointed portion, next the deep furrow which partially divided the mass, and by which it became separated into two. The metal here was marked over with small spots like corrosion, and seemed less pure and crystalline, appearing as if mixed with dross. A portion of this latter part was given to Dr Murray Thomson to examine

An opportunity was also taken of repeating, on one of the polished slices, the etching with acid, to see if it was possible to get a more distinct display of its peculiar crystalline structure, by watching the action of the acid on the metal. In place of using the mixed nitric and glacial acetic acids of the steel engraver, as was formerly done, nitric acid alone was used; but little or no effect was produced, with the exception of a very slight etching on the part first touched. The nitric acid was then diluted with about an equal quantity of water, and on its being again applied to the metal a rapid action took place, with a considerable evolution of gas, and a brownish or dark-coloured matter (carbonaceous ?) was seen to rise and mix with the acid solution, not from the coating protecting the rest of the metal, but from the bitten surface of the metal itself. The presence of this brown-coloured matter is stated not to be observed when ordinary steel is etched. Instead of making, as before, a large etched patch at the line of separation or fracture, of the rounded and pointed portions of the mass of iron, a small patch was etched near the middle of the rounded or lobed portion (fig. 1), and this displays very distinctly the characteristic and beautiful frosted-like lines of crystallization, crossing one another at various angles. As formerly stated, these lines are finer, or more minute, than in many meteoric irons. This finer texture seems to be also present in other brittle irons; at least it is mentioned as occurring in those described by Professor Shepard in his Report. (See "Silliman's American Journal," 1847.) I am inclined to think it not improbable that this fine, or less-distinctly marked te

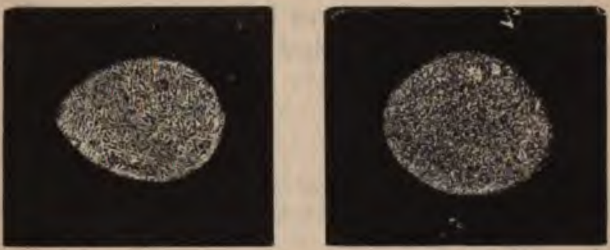
Fig. 1. Fig. 2.

Impressions of etched portions of the meteoric iron.

may be simply dependent on the rapid cooling, or any other cause which gives the iron its brittle character. Another patch of etching was made near the narrow extremity of the pointed portion of the mass (fig. 2). Here the crystalline structure of crossing lines is less distinct, the metal being apparently more granular in its texture, and exhibiting a series of shining points. The action of the diluted acid on the metal was closely watched, and was stopped occasionally, so as to preserve the appearance of the etching, when its character was most distinct. Wax squeezes and electrotype casts were taken from these etched surfaces, and are here printed from as woodcuts (figs. 1, 2). They may therefore be compared with that figured before, which was taken in a similar way from the central part of the meteoric iron.

A portion of this meteoric iron, with plaster cast of the entire mass, are now preserved in the Natural History Museum, Edinburgh; the principal part of the iron is in the British Museum, London.]

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## *Analysis of the Meteorolite described in the foregoing paper by Dr John Alexander Smith.* By MURRAY THOMSON, M.D., F.C.S., Lecturer on Chemistry.

In giving a chemical description of this remarkable mass of meteoric iron, I have to call attention, in the first place, to its Specific Gravity; the process of taking which was first per-specific gravities of iron and nickel meteorolites as ranging from 6·5 to 8·00. After the mass had been divided, the specific gravity was taken in a similar manner to the above, and the larger, heavier, and more solid half, gave a specific gravity of 6·499; the smaller and lighter half, as already mentioned by Dr Smith, having been broken in two, the process of taking the specific gravity was repeated on each of these, with the following results:—

| | |
|---|---|
| The smaller, rounded, or lobed portion gave, | 6·1919 |
| The larger, or pointed portion of the mass, | 6·7400 |

The higher specific gravity of the pointed portion is apparently accounted for by its having been compressed more than the other parts. Dr Smith has also noticed that this portion was stated to be tougher before the edge of the graver.

The analysis was made on some filings of the mass obtained before polishing the surfaces of the halves. I should have preferred for this purpose a sample derived from various parts of the mass, but this, it would appear, was not easy to obtain without endangering the good appearance of the meteorolite.

There is no point in the analysis calling for special description, except, perhaps, the determination of the nickel. This metal was estimated by dissolving a known weight of the meteorolite in hydrochloric acid, and after separation of the gangue of carbon and silica, the iron was peroxodized by heating with nitric acid, and then the iron oxide was precipitated by carbonate of baryta, and the excess of baryta afterwards removed by sulphuric acid. The precipitate of sulphate of baryta was separated by filtration, and the filtrate presented a decided green colour, which on concentration was deepened, showing the amount of nickel it contained to be considerable. The nickel in this solution was then precipitated and weighed as oxide. To arrive at a good result, it was necessary to operate on as much as 60 or 70 grains of the meteorolite. In the course of this process other metals, such as manganese, chromium, cobalt, as well as magnetic oxide of iron, &c., were carefully sought for, but no trace of them could be discovered. The qualitative analysis, therefore, showed the presence iron, nickel, carbon and silica, and these are present in the following proportions per cent.:—

| | |
|---|---:|
| Iron | 93.51. |
| Nickel | 4.86. |
| Silica | 0.91. |
| Carbon | 0.59. |
| | 99.87. |

It will be seen therefore that its composition is very simple, but at the same time not unlike that recorded in the analyses of other masses of meteoric iron. The occurrence of nickel in it in such marked quantity, sets at rest any question that might be raised as to its meteoric origin. Though one or two pieces of undoubted meteoric iron exist without any nickel in their composition, yet that metal is held by Shepard (vide Silliman's Journal, [illegible]) to be the second most frequently occurring constituent.

After the above communication was written, and as a portion of the mass had been cut into pieces of various sizes, another opportunity was had of taking the specific gravity of a slice (separated into two portions), embracing the whole thickness of the mass. These pieces being more manageable for the purpose of taking density, it is to be presumed that the following numbers express, with the utmost accuracy, their specific gravity:—

It has been already stated that the portion of the meteorite used for analysis was that obtained by filing the exposed faces of its halves; it might therefore be objected, that the material so procured, at least from the harder portion, was likely to be mixed with particles of the file used, and especially that the percentage of the carbon in the meteorite might thereby come out too high. It certainly cannot be denied that minute particles of the substance of the file would mix with the filings; but from the texture of the mass these must have been but a very trifling proportion, compared to the bulk of the filings. To be certain, however, that no substantial error had crept in from this source, another determination of the carbon and silica was made on a solid piece of the meteorite, the result being to show the presence of these constituents in the following proportions:—

| | |
|---|---|
| Carbon, . . . . | 0·56 per cent. |
| Silica, . . . . . | 0·90 „ |

These new percentages being so close to the last, we may regard the first analysis as quite correct.]

### III. *On Professor M'Coy's Ray without a name, taken in the Firth of Forth, May* 1861. By William S. Young, Esq. (The Specimen was exhibited.)

After carefully examining several authorities, I have come to the conclusion, that this ray is the same as one described, but not named, by Professor M'Coy, in the "Annals of Natural History," vol. vi. p. 405, and which Yarrell, quoting Thomson, places under the species of Sandy or Cuckoo Ray. Couch, in his work on the "History of the Fishes of the British Islands," now coming through the press, arranges them as two distinct species, and neither description coincides with the specimen now before us.

The specimen M'Coy got in Dublin bay was considerably larger than this one, being 17 to 18 inches long, and 9 to 10 inches broad. He says its outline,—the semicircle of spines or inner margin of the eye, and the spines at the tip of the snout, are the same as in the Sandy Ray; and that it resembles the Sand or Homelyn Ray, in having one sp each pectoral,—that is, a circular spot of chocolate brown, surrounded by a circle of white irregular spots, and some irregular white markings in centre, instead of the numerous small white markings of the Sandy Ray. It differs from the Sandy Ray, in having the surface of the body covered with minute spines, directed backwards,—the Sandy Ray being smooth, although Yarrell describes it as covered with spines. This specimen also differs from the Sandy Ray in its tail being long, whereas in the latter it is remarkably short; and, having the characteristic outline and disposition of the spines of the Sandy Ray, easily distinguishes it from the Sand or Homelyn Ray.

M'Coy thus gives the description of his fish, which so closely agrees with this specimen, that except in one or two minor particulars they appear to be the same species:—

"Spiracles immediately behind the orbits. Skin rough above, with the spines largest on the anterior margin of the pectorals. Semicircle of six or eight spines round the inner margin of the orbits, and a few on the top of the snout; four short rows about or a little before the middle of the back (these, I think, are the transverse rows forming the triangle at the upper extremity of the rows of large spines); two rows equally large spines down each side of the tail; four rows of large spines on the tail pointed backwards; central line comparatively unarmed; all the larger spines radiated at their base. Pectorals more abruptly rounded off an equilateral triangle of large spines, all turned backwards at an angle of about 50°, except the two large spines at the extremities of the base, which are nearly upright. From the base of this triangle down the back to the tail there are three rows of large spines, one on the central line, and one on each side of it; and outside of these are a considerable number of somewhat smaller spines irregularly placed. From the commencement of the tail to half-way to the tip there are three rows of spines on each side, the intermediate row being the smallest, and the only one continued to the extremity of the tail. The central line is armed with spines throughout its whole length. The under part of the tail is smooth, but at the margins thickly studded with a row of small spines. The whole of the large spines, with the exception before mentioned, are directed backwards, at an angle of about 50°. The spines on the central line are not so fully developed as those on each side of it, but still perfectly distinct. All the large spines are very much more radiated at the base than the smaller ones covering the back. The pectorals are very abruptly rounded off at the posterior extremity. The colour is light yellowish-brown, with two large chocolate-coloured spots, irregular in outline, containing a few (from three to five) cream-coloured markings. These large spots divide the breadth of the fish into three equal parts, a little way below the base of the triangle of spines.

This is therefore not a variety of any known species, but a new one. Professor M'Coy records his specimen as far back as the year 1841; and I beg to propose that this species be named *Raia M'Coyii.* This specimen was got in the month of May last year, in the well-known fishing-ground off Pittenweem called the Fluke Hole.

The Secretary stated that as several communications still remained to be brought before the Society, he begged to move that an extraordinary meeting be held on Wednesday, the 7th of May. The motion was unanimously agreed to.

*Wednesday, 7th May 1862.*—John Coldstream, M.D., President, in the Chair.

The Secretary laid on the table new Parts of Vol. II. of the Proceedings of the Society, which he hoped would be ready for distribution to members in a few days.

The following donations to the Library were laid on the table, and thanks voted to the donors:—

1. *Description of a New Species of Clerodendron from Old Calabar, which flowered in 1861 in the Royal Botanic Garden of Edinburgh. Plate.* By Professor J. H. Balfour, A.M., M.D., &c.—From the Author. 2. *Proceedings of the Literary and Philosophical Society of Liverpool, No. 15. 1860-61.*—From the Society. 3. Journal of the Geological Society of Dublin, Vol. viii. Part 3.—From the Society. 4. The Canadian Naturalist and Geologist, and Proceedings of the Natural History Society of Montreal, Vol. vi., No. 6. December 1861; and Vol. vii., No. 1. for February 1862. 5. The Canadian Journal, New Series. No. 37. January 1862.—From the Canadian Institute. 6. *Proceedings of the Royal Society*, Vol. xi. Nos. 43-47.—From the Society. 7. *Observations and Experiments on the Carcinus mænas.* By W. Carmichael M'Intosh, M.D. Prize Thesis, 1860.—From the Author. 8. *Transactions of the Botanical Society of Edinburgh*, Vol. vii., Part 1. —*From the Society.*

*The following communications were then read:—*

### 1. *Notes of the Capture of the Red-Crested Whistling Duck* (Fuligula rufina, *Pallas*) *in Argyleshire; and of the Common Wild Duck building on a Tree.* By John Alexander Smith, M.D.

Dr Smith read a communication from J. W. P. Orde of Kilmory, Esq., on the capture of a male of the *Fuligula rufina*, the Red-Crested Whistling Duck, which was shot built of birch twigs, and lined with down, and was apparently the work of the bird itself, and not the old one of any other bird. Instances of wild ducks occasionally using the nests of other birds, have been observed, and even at as great a height as thirty feet from the ground. In these instances, it is believed, the young birds are brought down to the ground by the bill of the mother.

## II. *Note on a case of Abnormality in the Ossification of the Parietal Bones in the Human Fœtus.* By R. H. Traquair, M.D.

Some time ago I dissected the head of a human fœtus of between the eighth and ninth months, in which the parietal bones presented a condition apparently at variance with the well-known rule, that these bones are two in number, and each developed from a single ossific centre.

In this cranium the parietal bone of the left side is perfectly normal, being ossified from one centre, which corresponds with the well-marked parietal eminence.

On the right side, however, the part which represents the parietal bone is divided into two distinct pieces, in a line extending from the middle of its posterior margin obliquely forwards to a little above its anterior inferior angle. Of these two pieces, each of which is of course ossified from its own centre, the lower is accordingly somewhat triangular, and is equal in size to one-half the upper rudely quadrangular part; and the two pieces form together a double parietal bone, which is larger by about one-fourth than the single bone of the opposite side.

This cranium is therefore abnormal—

1. In possessing three parietal bones instead of two.

2. In the asymmetrical disposition of these bones, two being on one side, one on the other.

3. The vault of the cranium is also asymmetrical in this respect, that the double parietal bone of the right side is considerably larger than the single one of the left.

The only other analogous case of which I am at present aware, is one recorded by Von Sömmering.* He has de-

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* Tiedemann und Treviranus Zeitschrift für Physiologie, ii. 1826.

Cuvier and Professor Buckland, inconsistent with the Testimony of Moses and the Phenomena of Nature." A general description of the superficial accumulations has been given by Mr Milne-Home in a valuable memoir "On the Lothian Coal-Fields." This author states, that it is possible to identify and individualise at least seven formations, each having separate characters, and probably belonging to different epochs. Under the existing soil supporting vegetation, there is, 1*st*, An upper covering of gravel and boulders; 2*d*, A deposit of sand and shells; 3*d*, Beds of fine sand; 4*th*, Beds of fine clay; 5*th*, Coarse gravel or stony clay; 6*th*, Lowest boulder-clay; 7*th*, Beds of sand and gravel. In the "Lithology of Edinburgh," Dr Fleming divides the strata belonging to the modern epoch into three groups,—First, The Taragmite series, formed subsequently to the dressings and groovings of the solid rocks, and, where present, reposing on them. They seem to have been formed when violent aqueous movements were taking place, and probably at a period when the state of our island was widely different from the present. The second, or Akumite series, is chiefly characterised by its laminated clays and sands, and indicates the assorting power of water under circumstances of comparative tranquillity. The third, or Phanerite group consists of deposits produced by causes in ordinary operation, and respecting the circumstances under which they have been formed little obscurity prevails. I had repeated opportunities of visiting the critical sections in this neighbourhood with the late Professor Fleming, and of verifying the accuracy of his observations. I shall therefore make use of these generalised expressions in the remarks which follow.

The lowest bed of the Taragmite group which has been observed in this neighbourhood consists of loose angular fragments of rock, 2 to 3 feet thick, which rest on the edges of strata composed apparently of the same materials, and in other places of sand and gravel. The extent of this basement deposit is at present but little known. The result of three borings, shown in a diagram which is copied from one in possession of Mr George Robertson, civil engineer, proves that the basement bed of the Taragmite series is of considerable extent in the neighbourhood of Leith. Two of the borings were made for the purpose of Artesian wells, and one for the foundation of a splendid work of art, the new Graving Dock. At a flour-mill situated near the west end of Leith Docks, the section passes through 80 feet of boulder-clay, then through a bed of sand 22 feet thick, resting on the solid rocks. The excavation made for the Graving Dock passed through 24 feet of marine sand; and the boring shows that the boulder-clay is here 35 feet thick, when a bed of sand is again reached 18 feet in thickness, or 4 feet less than at the flour-mill section. At the rope-walk on the north side of Leith Links, the boring passes through a bed of marine sand 30 feet thick, then through 70 feet of boulder-clay, which at this place is found to rest on the mineralised strata, without any intervening bed of sand. Mr Milne-Home, in his "Memoir on the Lothian Coal-Fields," says, "that at Leith, and in the manufactory lately occupied by a Mr Burstall, a well was sunk through the boulder-clay 45 feet. A bed of sand and fine gravel was then reached, from which water immediately gushed up, showing that the bed was probably of considerable extent." I am informed that the boring referred to by Mr Milne-Home was made in King Street, a little to the eastward of South Leith Poorhouse; and the borings since then instituted confirm his remark, and prove that this deposit underlying the boulder-clay is of considerable extent in the neighbourhood of Leith. This lower stratum of sand and shivers possesses a peculiar interest, inasmuch as it seems to imply that a period of time elapsed between the dressings of the rocks and their covering by boulder clay, portion of sand, and several horizontal layers of sand and gravel distinctly stratified, one of which, at 6 feet below the surface of the clay, was 16 inches thick, and could be traced for 20 feet.

The Akumite group in the ascending order of the superficial strata consists of three distinct kinds of deposits—silt, sand, and gravel. Sections occur in this neighbourhood to prove that, subsequent to the deposition of the Taragmite series, and previous to the commencement of the Akumite group, extensive denudation had taken place, by which the newer or upper portion of the Taragmite beds had been removed. In all the sections examined in this neighbourhood, the silt appears as the basement bed of the Akumite series, and, where present, is seen to rest immediately on the boulder-clay. There is evidence to show that in all probability the Akumite group may be regarded as a lacustrine formation, into which marine remains have occasionally been thrown by irruptions of the sea. Like the Taragmite formation, in passing upwards it graduates into sand and gravel; and where sand occurs without the boulder-clay or silt being exposed, its true relation cannot be satisfactorily determined. There are grounds for supposing that deposits of sand belonging to the boulder-clay and silt periods have been frequently confounded with a bed of marine sand of a different origin, to which the name of raised sea-beach bed has been given. This bed belongs to the third group in the ascending scale, or Phanerite series, of the superficial accumulations; and although, as its name implies, it presents characters very distinct and easily observed, it has nevertheless formed the subject of much geological controversy.

At the concluding meeting of the Royal Physical Society for 1859, I gave a brief description of that portion of the so-called raised sea-beach bed which extends between the old sandstone quarry at Granton and the Magdalen Burn, near Fisherrow. I then stated that the lateral extent of this so-called raised sea-beach bed, and its relation to other accumulations of a similar lithological structure, but destitute of any trace of marine remains, had not yet been satisfactorily determined. The importance of this investigation will be readily admitted when it is considered that it forms, as it were, the starting point whence the great generalisations of geology begin. The raised sea-beach bed is described by Hutton, and is alluded to by his eloquent disciple Playfair, in his "Illustrations of the Huttonian Theory," p. 446. "The marks of an ancient sea-beach," he says, "are to be seen beyond the present limits of the tide, and beds of sea shells, not mineralised, are found in the loose earth or soil, sometimes as high as 30 feet above the present level of the sea. The ground on which the Botanic Garden of Edinburgh is situated (the Old Botanic Garden in Leith Walk), after a thin covering of soil is removed, consists entirely of sea sand, very regularly stratified with layers of a black carbonaceous matter, in thin lamellæ, interposed between them. Shells, I believe, are but rarely found in it, but it has every other appearance of a sea beach." In the "Lithology of Edinburgh," Dr Fleming, in reference to the remarks of Playfair, says,—"The assumption here of 'sea sand' and 'sea beach' seem alike unwarrantable from the description given of the sand; and I may add," he says, "that the occurrence of sea shells in the sand has not been since authenticated." On the high ground that extends between Granton and North Leith, thence inland towards Edinburgh, I have had opportunities of examining numerous excavations and sections where deposits of sand and gravel are frequently exposed, without finding a trace of marine remains. These deposits constitute the upper portion of the Taragmite and Akumite series, and

Buildings. The cutting passed through 2 feet of soil, and from 2 to 4 feet of ferruginous sand, in which no marine remains could be detected. The extent of the drain, from the margin of the cliff (which is here vertical) up to Anchorfield Buildings, was 90 feet, with a rise of 5 feet. For several years past the sea has been making rapid encroachments upon this part of the coast; and there is evidence to show that, during the last forty years, 90 feet of cliff with a similar gradient has crumbled down and been removed. The bed of sand, which rests on the boulder-clay at a height of 12 to 15 feet above high-water mark, has been considered a portion of the so-called raised sea-beach bed. It would then have been 5 feet lower than at present, and, if the slope continued at the same gradient seaward, would come in contact with the ripple-zone, composed of materials similar to what is now observed at the base of the cliff. This zone extends between the limits of the high-water marks of spring and neap tides, where sands and gravel are thrown up in ridges of ever-varying elevation, and amongst which marine rejectamenta of the most varied character are to be found. The nature and contents of the present ripple-zone deposits are similar to those composing the so-called raised sea-beach bed; and it is difficult to conceive they could have had a different origin. An attentive examination of the heterogeneous contents included in the older deposits, as exposed, for example, at the Foul Burn between Leith and Portobello, will not fail to satisfy the zoologist that the remains of molluscan life, huddled together in a bed several feet thick, could never have been associated during life. The bed is seen resting on the boulder-clay at the level of ordinary spring-tides; and at one spot is even interrupted by a slight rise in the clay of only 3 or 4 feet above the level of the tide. At this place the sea is observed to be again encroaching on the older deposits; and from observations made by my friend Mr William Young of Fillyside, it appears that 10 or 12 feet of the low cliff has fallen down during the last twelve months. Three years ago, a great abundance of living oysters were cast ashore from the oyster-bed that lies off at a short distance in one or two fathoms water. Several of our geological writers have appealed to the marine shells contained in the so-called raised sea-beach bed, to prove that a rise in the bed of the Forth has taken place within a comparatively recent geological period. In "The Lithology of Edinburgh," the instances adduced are proved to be unsatisfactory, and neither in accordance with the habits of the animals nor with the mode of distribution of the materials of a sea beach.

An attempt has lately been made to prove a rise of the coast of the Firth of Forth within the historical period, by an appeal to the so-called raised sea-beach bed deposits. It is contained in a communication by Mr Archibald Geikie, of the Geological Survey, and published in the "New Philosophical Journal" for July 1861. Mr Geikie states that he found "fragments of Roman pottery in a stratified deposit of marine silt, the deposition of which was going on during the Roman occupation of Britain." He says that "the strata with which this bed of silt is connected lie 25 feet above high-water mark, and are unequivocally those of the raised beach;" and therefore he infers that a rise in the land to this extent has taken place here since the time of the Romans.

In a communication to the Royal Society of Edinburgh by Mr A. Bryson, "On Hasty Generalisation in Geology," it was shown that this so-called marine silt-bed* (No. 5 of Mr Geikie's diagram), supposed to be of the Roman age, contained also abundance of broken pieces of recent pottery, fragments of bone belonging to the sheep and ox, and bits of burnt coal deposit in the section consists of a bed of sandy clay, three or four feet thick, superimposed upon stratified beds of sand and gravel, and can be traced by its small columnar structure, due to shrinkage in drying and exposure, so characteristic of clays, as also by its light brown colour, onwards to the northern extremity of the section. This bed gradually blends with a dark unstratified mass of old humus, which, at the north end of the pit, is overlaid by a tongue of shot sand, with patches of humus intermixed, presenting an appearance of two beds that are represented in Mr Geikie's diagram as beds 5 and 6. Bed No. 7, which Mr Geikie says "is the highest in the section, and consists of stratified sand and shingle, full of littoral shells, and some balani still attached," is not seen in the sand-pit section; and the only representative that has been observed is a narrow strip of marine shingle and sand, mixed with humus, laid down at the bottom of the garden. The whole of this locality is overspread with artificial deposits. A diagram, prepared by Mr Sharbau, assistant marine surveyor, gives a correct representation of the phenomena observed in this sand-pit section. The lowest bed consists of sand and coarse shingle, and contains abundance of worn marine shells, the balani adhering to the interior of the oyster valves. This bed is four or five feet above the sea level, and its character and contents are identical with a ripple-zone deposit. The overlying stratum is composed of marine sand, and varies in thickness. In this sand-pit it is five or six feet, whilst in an adjoining one, a few yards to the eastward, and now filled up, it was eleven feet thick, and contained abundance of worn marine shells and comminuted fragments. It is continuous with the bed of marine sand, in great part blown, on which the town of Leith is built, and is connected to the shore sand. This bed is frequently exposed in foundations for buildings and cuttings for drainage, and when passed through is found to rest on the boulder clay. The deposit of sand and gravel which overlies this bed in the sand-pit section is destitute of marine remains, and appears to be of fluviatile origin. It is remarkably irregular, and rises at the south end of the sand-pit into a protuberance six feet thick. The bed of marine sand disappears in the direction of the river, and the gravel is cut off to the eastward, where the overlying bed of sandy clay, and the lower bed of marine sand are observed to come in contact. This protuberance of sand and gravel extends towards the centre of the sand-pit, where a depression occurs which has been filled up with humus. This short lateral ridge of sand and gravel presents an appearance similar to what is formed by the bifurcation of rivers, or by currents heaping up deposits along their margins. The uppermost bed of sandy clay, which forms part of the so-called stratified marine silt, has all the characters of a marsh silt or lacustrine deposit; and the neighbouring hollow indicates the existence of a former lake. This is still a marsh, over which the Water of Leith occasionally flows as far as the Bonnington road; although the river is now confined within narrower limits, and guided by piers across the extensive foreshore of flat sand to its junction with the sea.

### IV. *On the Danger of Hasty Generalization in Geology; with Special Reference to the so-called Raised Sea-Beach at Leith.* By ALEXANDER BRYSON, Esq., F.R.S.E.

As my friend Dr M'Bain was to favour us with a communication on this subject this evening, I thought it might interest the Society to add, as a sequel to his observations, a few notes, some of which were formerly brought by me before the Royal Society here.

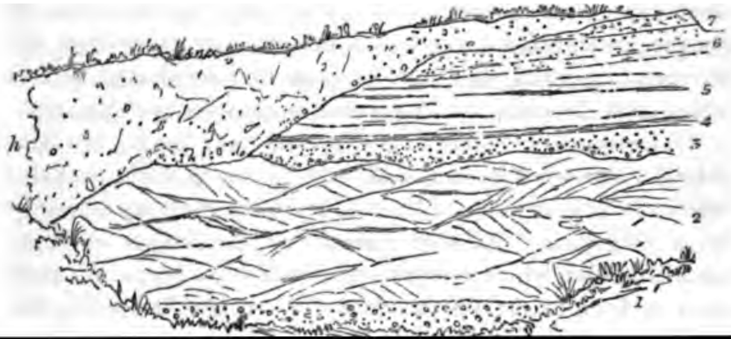
carboniferous fossils in the primitive limestone. Fortunately for truth, a friend obtained many similar specimens in the establishment of a marble-cutter in Leith Walk, where I soon found the true explanation of the structure which had led me to maintain its organic origin.

It is usual for the marble-cutters at Carrara, before sending out the blocks from the quarry, to reduce them into as small dimensions as possible. This operation is performed by what is called a matting-hammer, consisting of many separate and blunt teeth placed alternate to each other, and is used by bringing the hammer down, in a perpendicular direction, to the flat face of the marble block. By this method a series of quinquncial indentations are produced precisely similar to those found in Stigmaria, and, to render the illusion more perfect, where the percussion of the teeth of the hammer is greatest (which is at the point), the limestone at the bottom of each depression is more crushed, and being deprived of its air by the greater force, exhibits a different structure from the surrounding walls, and thus presents the regularity, both in shape and direction, of the protruding petioles of Stigmaria.

Unfortunately, before this discovery was made, my dear friend Professor Fleming died, and I have no doubt that this specimen is now lying in his cabinet, labelled on my authority as a Stigmaria. Another instance of the danger of hasty generalization which occurred to myself—the supposed native lead of Inch Mickery—was formerly brought before this Society, and is published in our Proceedings, vol. ii. p. 85.

I have now to deal with another instance in which a hasty generalization has met with more attention in the geological world than any of those I have mentioned, but not less than it deserved. Mr Geikie, in a paper published in the "Edinburgh Philosophical Journal," vol. xvi. p. 102, has stated his belief that the ground on which Leith is situated has risen to the extent of 25 feet since the Roman period. The section from which he has come to this conclusion is in a sand-pit at the Junction Road, Leith, and is represented in the diagram, which is the same as Mr Geikie used to illustrate his paper. He thus describes the succession of the strata as seen in the sand-pit:—

"The lowest bed (1) visible is one of coarse gravel or shingle, the pebbles being all well rounded, and loosely cemented in a sandy and somewhat ferruginous matrix. (2) Is a bed of fine white sand, about six feet thick. It is full of false bedding, the diagonal stratification being beautifully exhibited by the alternations of darker and lighter coloured layers. Its upper surface is irregular, and is overlaid by a well-marked seam (3) of sand and gravel, which averages about sixteen inches in thickness. Its lower part is gravelly and ferruginous. This stratum is covered by three or four inches of a stiff greenish clay (4), which contains numerous perpendicular (sometimes dichotomous) ferruginous pipes, probably marking the remains of the stems of plants. This stratum passes up into a bed (5), about six feet thick, of dark silt or sandy clay well stratified, having thin lenticular interlaminations of sand, with occasional oyster-valves, a few



earthenware, tobacco-pipes, &c., and its origin is sufficiently explained by a large board a few yards distant—'Rubbish may be laid down here free.'"

"It is with the stratum marked 5 that we have chiefly to deal. But before entering into its details, I would dwell pointedly on the fact, that it is a regularly stratified deposit, with thin parallel interlaminations of sand and clay; its oyster-valves and stones lie horizontally, and it passes upward by gradations into brown sand, which is covered by well stratified shell-sand and gravel. It cannot for a moment be confounded with the dark earth *h*, in which no trace of stratification can be detected, and which, moreover, rests on the edges of the other deposits. Whatever may be the contents of this bed of silt, they are undoubtedly of contemporaneous deposition; in other words, all the materials imbedded in the stratum were laid down at the same time with the stratum itself. And that this deposition and arrangement were effected tranquilly by the tides, is abundantly manifest from the stratified aspect of the bed, as well as from that of the sand which covers it." In this bed (5) Mr Geikie found pieces of pottery and bones, to which he thus alludes:—"The pieces of pottery found by Dr Young and myself were of two kinds; the first and most abundant were of a pale yellowish-grey colour, from two to nearly six lines in thickness, and of a firm compact, but somewhat granular clay. They showed no glaze, but had a rough exterior and a rounded form like fragments of a flagon or urn. All the pieces we obtained occurred in the space of two or three yards, and might have belonged to one vessel. We also found, however, one or two fragments of a thinner and finer kind of pottery of a red colour, and coated with a pellicle of greenish glaze. Having obtained as many fragments as could be gathered, after a careful search during two visits to the sand-pit, we submitted them to Mr M'Culloch, the curator of the Scottish Antiquarian Museum, requesting his opinion before informing him where they had been found. He at once pointed out, that they strongly resembled fragments of Roman pottery; and he stated, that if found near a Roman station, he would have no hesitation in pronouncing them to be Roman." "We have no doubt, therefore, th the pieces of pottery embedded in the elevated littoral silt of Leith are of Roman origin."

"Along with these remains occurred numerous fragments of the bones of some ruminant, apparently a deer. With the exception of a broken tibia, all the pieces were of small size, like little chips and splinters. There occurred also a number of ferruginous pipes of irregular size and form, occasionally branching. They arose probably from the decomposition of ferruginous soil round the decaying stems of plants, though they sometimes resemble annelide burrows.

"I have just shown that the bed of silt in which these remains occur, is a truly stratified deposit formed by water, exactly as a similar silt is being laid down on the shores of the Frith at the present day. The occurrence of stratified shell-sand and shingle above this silt proves that it was a littoral deposit; and the inference is irresistible, that the land here has risen about 25 feet since the deposition of these littoral strata. Further, the existence of fragments of Roman pottery in the silt shows us, that the deposition of these upraised strata was going on during the Roman occupation of Britain, and therefore that this rise of the land has taken place since the time of the Romans. This may seem, indeed, a startling deduction, when we consider the comparatively large increase of land which it demands, the short interval it allows for the process of elevation, and the silence of historians as to any change of level. But these objections are only was found, on which Mr Geikie lays so much stress, and is indeed the *point d'appui* of his whole argument. Instead of finding this bed to be of marine origin and distinctly stratified, as Mr Geikie has described it, we found it (as any one can determine the fact for themselves) to consist of two distinct beds. The lower one, which rests on gravel, is evidently a marsh silt due to the overflowing of the Water of Leith, the remains of which may still be seen about 100 yards to the west. That this marsh existed not in the Roman age, but within the memory of the oldest inhabitant, is rendered highly probable, by the situation bearing the name of Puddock Hall, evidently from its proximity to the abode of frogs. That this marsh silt was deposited long posterior to the Roman occupation, we shall endeavour in the sequel to prove. The silt stratum or lower portion of bed (5) contains no remains of animals nor pieces of pottery; when dessicated by exposure to the air, it separates into prisms perpendicular to the clay-bed below, and is thus easily differentiated from the upper stratum in which Mr Geikie found the so-called Roman pottery.

The upper portion of No. 5 is distinguished from its lower congener by numerous vesicular coal cinders, evidently acted on by heat, and as the matrix shows no symptoms of fusion from internal heat or otherwise, I take leave to denominate as simply coal ashes. Side by side with the incinerated coals we found oyster shells, not *all* lying flat, as deposited in a bed, but at *all* angles to the horizon, precisely as any one may find them in a humus bed, where a farmer, knowing their worth for manure, had shot them in at random. Nor were the stones, as Mr Geikie has said, lying on their sides (as would have been the case if this bed had been a lacustrine or marine deposit) but were arranged in as higgledy-piggledy a manner as the oyster shells. We, with the assistance of Mr Field's men, had no difficulty in supplying ourselves with from thirty to forty specimens of pottery, also bones of sheep, the common ox (*Bos taurus*), teeth of the same, and also of the horse. Only one evidence of the deer was found, and that was a tooth. Before entering into the further proof of this bed being of *very* modern origin, let us consider first the occurrence of the burned coal so largely sprinkled through its mass, and ask [illegible] to Mr [illegible] the question was [illegible] so commonly [illegible] at the period of the Roman invasion, so as to yield so large a percentage of the bed." For myself I answer in the negative. With regard to the [illegible] of the oysters and cockles I have [illegible] been interested in the controversy [illegible] [illegible]: but I cannot help expressing my own opinion that the number of oyster-shells in the upper part of bed 3 are not greater than can be found in any recent bed supplied by the manure of the city of Edinburgh; nor are they evidence of marine deposition more than can be afforded by any well-cultivated field of Mid-Lothian. I shall now advert to the character of the pottery found in bed 3, where Mr [illegible] found his Roman pottery. Above I have stated that we found upwards of thirty specimens of the fictile art; these were submitted to the inspection of Mr Birch of the British Museum, the first authority we have in the kingdom as regards pottery. His answer was, "Not one piece is of Roman origin."

Another gentleman, second only to Mr Birch in his knowledge of pottery, pronounced them to be of local and modern origin; in this opinion he was both right and wrong. In regard to the pottery being of local origin, I found that the red pottery owed its formation to a manufactory at Portobello, where elegant jugs after the Etruscan mould were made to hold butter-milk, and the others were remains of neat glazed flower-pots from Holland, which forty years ago the skippers forty years ago cultivated this identical bed before beds Nos. 6 and 7 were laid down.

The question now arises, how were the beds 6 and 7 laid down? Bed (6) was the "tail end" of Mount Falcon, raised by Oliver Cromwell, and levelled over bed 5, when the road was made for the proposed advent of George IV. into Edinburgh in 1822. Bed No. 7, Mr Geikie describes as consisting of a true beach bed with all its shells and balani, and he is led to believe that the deposit was truly laid down by the sea. There are, however, two facts which at once set this aside: 1. The balani are often found on the stones with their valves *downwards*, instead of exposed to their native element; and, 2, bed No. 7 was taken out within eight years from the foundation of a house, and entirely consists of the same shells, &c., which form bed No. 1 of Mr Geikie's section, to which I shall now devote a few words, showing that it was formed within the historic epoch, and long after the advent of the Romans. From the Ordnance Survey map I have taken various contour levels of the streets and quays of Leith to the number of seventy-two. These give an average height above mean high water of 28·7 feet. Now, as the tides vary from neaps to springs about 16 feet, we must deduct from this half the amount, equal to 8 feet; this leaves for average tides a height of 20·7. Now, as the oyster bed of Mr Geikie, or rather his No. 1 (which I call a storm-raised bed) is 15 feet below the average of the streets of Leith, we have only to account for a storm-wave five feet in height, to throw up their so-called raised sea-beach bed so much insisted on by Maclaren and Chambers.

Such conditions of the tides have often been observed by the elder inhabitants of Leith, the effects of which could not of course affect land lying below the houses. But let us suppose the condition of Leith before or immediately after the Romans laid the "Fishwife's Causey," and man had not placed barriers against the sea, but that the piers, harbours, and houses of Leith, with all their defences, were removed, old Ocean would soon re-assert his former sway, and claim as his domain the links of Leith, and leave at all high tides, and during N.E. storms, effects equivalent to those which make this storm-raised bed the stumbling-block of all geologists who attempt to period that we have any very modern evidence of a subsidence of the sea or a raising of the land in the basin of the Forth.*

## V. — On the Pigmentary System of the Æquoreal Pipe-fish. By T. Strethill Wright, M.D.

A few weeks ago I received a specimen of this fish, from Mr Patton of Granton pier, in a very lively condition. It was placed in a large white vessel of water at ten o'clock at night. The colour of the fish was at that time a dark green, marked with the usual bands. On examining it the next morning, it had assumed a general hue of bright orange. Towards evening, again, dark-green patches appeared over various parts of the body. It was found the next morning dead on the carpet, having escaped from the vessel in which it was confined, and still retaining the clouded appearance which it possessed on the preceding evening.

The pigmental system of the pipe-fish consists of two layers of pigment-cells, which are capable of contracting themselves to mere dots, and of extending themselves until they coalesce. In the outer layer these cells have a dark-brownish green tint; in the inner layer a bright orange. The green cells are excessively branched when dilated. The orange cells tend rather to form uniform expansions. I endeavoured with the utmost care to detect traces of cell-walls in both species of cell, but was unable to do so. The pigment cell appears only to consist of nucleus and con-

Body, octangular; fins, pectoral, anal, and caudal, awanting. Length of fish, 19¾ inches; length of head, 1½ inch; point of snout to orbit, ¾ inch; front of orbit to extremity of operculum, ¾ inch; length from snout to anus, 9¼ inches; from anus to point of tail, 10½ inches; from snout to first dorsal fin ray, 7⅛ inches; length of dorsal fin, 2⅝ inches; from last ray of dorsal fin to point of tail, 9⅞ inches. The posterior termination of the dorsal fin is therefore nearly in the middle of the fish.

The body consists of twenty-nine rings or divisions, the anus being in the twenty-ninth; the tail of about sixty. No depressions were observed on the abdomen,—probably a female. Dorsal fin, of thirty-nine rays, resting on nine rings of body and two of tail [21st to 31st inclusive]; anus under twenty-eighth and twenty-ninth rays of fin. (For descriptions of other specimens, see pp. 290 and 291).

Professor Fleming, in his "British Animals," described this fish as rare, and called attention to the fact of its being "obviously pointed out by Sibbald, as an inhabitant of the Firth of Forth," in 1684. Yarrell also states that examples of this species are rare.

## VI. *Observations on British Zoophytes.* (1.) Vorticlava Proteus. (2.) Trichydra pudica. (3.) *On the Development of* Pycnogon *Larvæ within the Polyps of* Hydractinia. By T. STRETHILL WRIGHT, M.D.

### (1.) *Vorticlava Proteus.* (Plate XVII.)

Scleroderm absent. Colletoderm covering body of polyp. Upper row of tentacles capitate 5; lower row 9.

Several specimens of this zoophyte were found in the "Fluke Hole," Firth of Forth. The body of the polyp is exceedingly extensible. At one time a mere button attached to the stone on which it dwells; at another it transforms itself into the various shapes shown in the accompanying figures. A hard covering to the body would necessarily prevent or impede these motions. The scleroderm, therefore, is absent, and the whole body of the polyp is covered with a layer of transparent "colline," which extends from the foot, where it forms a thick mass, to a ridge which runs beneath the insertion of the lower rim of tentacles. The zoophyte has the power of changing its place.

*Description of Plate* XVII. (*Vorticlava proteus.*)

Fig. 1.—*Vorticlava Proteus* contracted.

Figs. 2, 3, 4, 5.—Same in different states of extension.

Fig. 6.—Diagram of the tissues of the polyp of *V. Proteus*; *a a'*, colletoderm attached to subtentacular ridge *b*; *c*, ectoderm; *d*, endoderm.

### (2.) *Trichydra pudica.* (Plate XXII.)

This hydroid, which I have already described to the Society, was found completely covering a small shell from the "Fluke Hole." As its mode of reproduction has never been observed, I placed it in a small vessel of carefully-examined sea-water, and exposed it to light, a mode of treatment which often induces the Hydroidæ to assume their medusoid phase. After some time, two small medusoids were found in the water, but I was unable, by the most careful examination, to detect their mode of development, as no "gonophores" appeared on any part of the cœnosarc. The connection of these medusoids with Trichydra is yet open to doubt, although I am convinced that no other zoophyte occurred on the shell, or in the water in which it was placed.

*Medusoid of Trichydra pudica?*—*Umbrella* mitre-shaped, covered with minute thread-cells. *Sub-umbrella* with four lateral canals, destitute of ovaries or sperm sacs. *Peduncle* short, cylindrical, four cleft at the mouth. *Tentacles* four, short, with two or four intervening tubercles. *Oolites* scribed the occurrence of certain vesicles on the branches of the *Coryne exima*, which, although possessing a strong resemblance to the reproductive sacs of the zoophyte, and formed of all the proper tissues of the cœnosarc and its coverings, were distinguished from those organs by each enclosing a single living Pycnogon, which, in the smaller vesicles, was embryonic, while in the larger it presented an advanced stage of development. A similar observation was made by Mr G. Hodge (*Ann. and Mag. N. Hist.*, ser. 3, vol. ix.), who considered that the sacs were modified or stunted branches of the Coryne, the development of which had been arrested by the presence of the enclosed Pycnogon. On reading the papers of these gentlemen, I remembered that I had, some time before, been much puzzled by the discovery of armless Pycnogons resembling Mr Hodge's figure (pl. iv. fig. 10, *op. cit.*) in several altered polyps of a specimen of Hydractinia. In this case two or three were found in each polyp, which had assumed the form of a dilated and transparent sac crowned by its usual tentacles. The polyps appeared to be bloated and overgrown under the use of their Pycnogon diet. Mr Hodge's paper at once set me on the look-out for another specimen of Hydractinia tenanted by Pycnogons, and this I at last obtained by the kindness of my friend, Dr Wilson, Demonstrator of Anatomy at the University of Edinburgh. In this, one of the polyps contained three larvæ of a pale yellow colour, which appeared, as far as could be seen without injuring the polyp, to be destitute of legs. When first observed, the polyp was furnished with its proper complement of tentacles; but as the development of the Pycnogons proceeded, the tentacles were absorbed, and the polyp became a long sac pointed at its upper extremity, and fitting closely on its contents, which appeared to be embedded in the longitudinal folds of the highly-developed endoderm. Mr Hodge supposes that the larvæ, at a very early stage, are swallowed by ordinary alimentary polyps of the Coryne, and carried through the tubes of the cœnosarc, until they arrive at a part which is about to become a polyp, which thereupon has its destination altered. And I think there can be little doubt that his surmise is correct, as in Coryne all Pycnogon sacs, in all stages of development, are not only destitute of tentacles, but are, according to Professor Allman, covered by a layer of the chitinous polypary or sclerodern. Such a mode of *nidification*, however, could not take place in Hydractinia, the cœnosarcal tubes of which are of exceedingly small calibre. Accordingly, we find that the Pycnogon sacs in this zoophyte are formed, not by the arrest or change in development of an immature polyp, but by the degeneration of a tentacled polyp previously perfect.

Perhaps I ought to mention here, that globular sacs are occasionally found in place of the polyp, in *Coryne glandulosa* (Dalyell). These are destitute of scleroderm, and lined with a very dense brown endoderm, arranged in somewhat reticulated folds. As far as I observed, they were empty, and, by constantly undergoing alternate processes of dilatation and contraction, appeared to influence the circulation of the zoophyte. It is possible that minute Pycnogons may have existed in these sacs.

### VII. *Report of the Committee on Marine Zoology.* By GEORGE LOGAN, Esq., W.S., Convener. (Specimens were exhibited.)

The Committee had several excursions in the Firth of Forth during the past season, and were occupied in trawling and dredging, and also in sweep-net fishing on the shore. Upon the 11th of May last, among numerous specimens of

Leith, and a large and beautiful specimen of *Serpula filograna* of Berkeley, found near the Bass, by means of an anemone taking a baited hook and bringing up along with it the mass of annelides to which it was attached. The Committee have the pleasure to report another fish new to the Firth of Forth, not noticed by Parnell, viz., the Poor or Power cod, *Gadus minutus* of Linnæus, *Morrhua minuta* of Fleming, and described by Yarrell, vol. ii. p. 241 of his "British Fishes," in a very interesting manner. This little fish was first detected during this spring among a number of the common codling, by Mr R. F. Logan, and was subsequently frequently noticed by the reporter in similar company, the fishermen always confounding it with the whiting-pout, or brassey, the *Gadus luscus* of Linnæus, which it much resembles. Some of the specimens were found to be full of matured spawn.

Through the energy of a member of the Committee (Mr William S. Young), a fine specimen of the Greenland shark, *Scymnus borealis*, caught on the Dogger Bank on 30th April 1862, was secured for the examination of the Committee, and Mr Young has favoured them with the following detailed description:—

"This specimen was presented to me by Mr Finlay, fishmonger, Leith; and as this is only the sixth instance, so far as known, that the Greenland shark has been observed in our seas, I thought it proper to make some observations and measurements.

"The measurements are as follow, which were carefully noted by Mr James B. Davies, of the Edinburgh University Museum:—

| | Feet. | In. |
|---|---|---|
| Dorsal line from snout to point of upper lobe of tail, | 8 | 6 |
| Snout to anterior angle of first dorsal fin, . | 3 | 8 |
| Snout to insertion of upper lobe of tail, . . | 7 | 0 |
| Ventral line from snout to insertion of lower lobe of tail, | 6 | 10 |
| Snout to abdominal fins, . . . . | 5 | 3 |
| Line from snout to anterior angle of second dorsal fin, | 5 | 10 |
| Line from angle of mouth to anterior angle of abdominal fins, . . . . . . | 4 | 9 |
| Angle of mouth to anterior angle of lower lobe of tail, | 6 | 3 |
| Straight line from point to point of tail, . | 1 | 9 |
| From same points in line of curve, . . | 2 | 2 |

| | Feet. | In. |
|---|---|---|
| Circumference,— | | |
| 1. At first spiracle, . . . . | 3 | 2 |
| 2 „ posterior angle of pectorals, . . | 3 | 7 |
| 3. „ „ „ first dorsal, . . | 3 | 3 |
| 4. „ „ „ abdominals, . . | 1 | 7 |
| Eye to ear, . . . . . | 0 | 4½ |
| Ear to ear . . . . . | 0 | 4 |
| Nostril to nostril, . . . . | 0 | 5 |
| From line of nostril to upper jaw, . . | 0 | 10 |
| „ „ point of snout, . . | 0 | 3 |
| Angle of mouth to insertion of pectoral fin, . | 1 | 7 |
| Angle of mouth to first spiracle, . . | 0 | 9 |
| Length of group of spiracles, . . . | 0 | 9 |
| Mouth, open—transverse, . . | 0 | 7½ |
| „ „ vertical, . . | 0 | 5½ |

"The colour was a uniform light-bluish grey, skin covered with minute hooked spines, hooks pointing backwards. A row of mucous ducts extended from the tail to the head, their apertures, four-tenths of an inch apart, forming the lateral line which branches off at the head into symmetrical curves. These ducts are about half an inch in length, and communicate obliquely with a longitudinal canal just under the skin, lined with a dark pigment membrane. On dissecting the fish, the liver, consisting of two lobes, each 5 feet in length, weighed 35 pounds.

| | Feet. | In. |
|---|---|---|
| Length of the stomach, . . . | 3 | 2 |
| „ intestine to first cœcum, . . | 0 | 9 |
| Thence to first turn, . . | 0 | 9 |
| Thence to vent, . . . | 3 | 9 |
| Pancreas—long fork . . . . | 1 | 9 |

those parts which were considered worthy of more critical examination.

"Three years since, in the month of May, a somewhat larger specimen than this was caught near Inchkeith, and is now preserved in the Natural History Museum, University."

In continuation of previous observations made during the course of the last three or four years, reported annually to the Society by this Committee, the Convener examined continuously the herrings and sprats brought to market during the whole fishing season, and the result has shown that, from the end of June to the end of September, and from the beginning of December to the beginning of March, herrings were taken having spawn in all stages of development, and the proportion of herring fry found among the sprats was even smaller than on previous occasions,—so far as observed, certainly not five per cent. on an average,—thus supporting the deductions drawn in previous Reports of this Committee. The Pilchard, or Gipsey herring, appeared along with the true herring occasionally or for short periods during the winter, and about the month of February large numbers of the sea bream were taken in the Firth.

A vote of thanks was given to the Committee.

### VIII. *On the Composition of a Pseudo-Steatite.* By MURRAY THOMSON, M.D., F.C.S., Lecturer on Chemistry, Edinburgh, and Mr MORD BINNEY, Student in Dr Thomson's Laboratory.

The mineral which is the subject of this short notice I have ventured on denominating a Pseudo-Steatite; it was found by John Gellatly, Esq., late of the Chemical Works at Bathgate, forming a joint between the masses of a kind of serpentine; which latter rock is esteemed of some value for the construction of certain parts of bakers' ovens, and for which purpose it is quarried close to the village of Blackburn, Linlithgowshire.

Mr Gellatly, while making a visit to this quarry, picked up some pieces of the mineral, and sent them to my pupil, Mr Mord Binney, simply with the view of furnishing material to him for analytical practice, and not at first under any impres-

The following are the physical characters of the mineral:—It occurs in irregularly striated masses of a dark-green colour, which here and there changes to a brownish tint; it has generally a dull surface, and when exposed to the air effloresces; fracture uneven; it is easily broken and reduced to powder, which has a green colour. Every part of the masses has the genuine soapy feeling of the steatite. Its degree of hardness is 2·2; as it is hardly scratched by gypsum, but is distinctly so by calc spar. Streak dark greenish grey, and sublustrous. It does not adhere to the tongue, has no taste, but has a slightly argillaceous odour, especially when a fresh surface is exposed. The specific gravity is 2·469. Before the blowpipe it is infusible, but changes in colour from green to brown; with borax a yellow head changing to green; with carbonate of soda a persistent dull green.

The results of our analyses are now appended.

| | Thomson. | | Binney. |
|---|---|---|---|
| Silica, . . . . . . | 41·89 | ... | 42·78 |
| Protoxide of Iron, . . . | 6·62 | ... | 6·31 |
| Alumina, . . . . . | 22·05 | ... | 22·53 |
| Manganese, . . . . . | traces | ... | traces |
| Lime, . . . . . | 2·42 | ... | 2·54 |
| Magnesia, . . . . . | 6·16 | ... | 6·76 |
| Water, . . . . . | 20·22 | ... | 18·68 |
| | 99·36 | ... | 99·60 |

| | $SiO_2$ | RO | $R_2O_3$ | HO |
|---|---|---|---|---|
| Oxygen ratio, | 4 | 1 | 2 | 3 |

## IX. *Notice of a Fœtal Narwhal* (Monodon monoceros, *Linn.*) By ROBERT BROWN, Esq.

Mr Brown exhibited a small fœtal specimen of a Narwhal (*Monodon monoceros*, Linn.); and stated that another fœtus was also found in the uterus of the same animal, which was captured in Davis' Strait, June 23d, 1861.

In the "Linnean Transactions" (vol. xiii. pp. 620, 621, "Extracts from Minute Book"), in a letter from Mr W. R. Whatton of Manchester, it is noted, that in the summer of 1821, while a Hull whale ship was beset in the ice in the

North Seas, the crew took a female Narwhal having a tooth in the upper jaw, perfect, and in every respect like that of the male, though not so long. The sex of the animal was satisfactorily ascertained in cutting up, *when two fœtuses were taken out of it.* Mr Brown was acquainted with similar instances of the "horn" being protruded in the female Narwhal; and though it is said to have been seen with two young following it, yet the instances mentioned were the only ones with which he was acquainted, in which the subject had been brought to an *experimentum crucis.* In all likelihood, the *Cetacea* in this respect follow the same laws as the other *Mammalia,* though our opportunities for observing the former were much more limited; and hence the value of every fact, however apparently trifling, being put on record.

Mr W. S. Young proposed a vote of thanks to the Presidents and other office-bearers, which was unanimously agreed to, and the Society adjourned until the commencement of the next Session.

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PLATE I

*Royal Physical Society, Edinburgh.*

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*Canadensis (Linn.)*

*Hutchinsii? (Rich.*

**PLATE II.**

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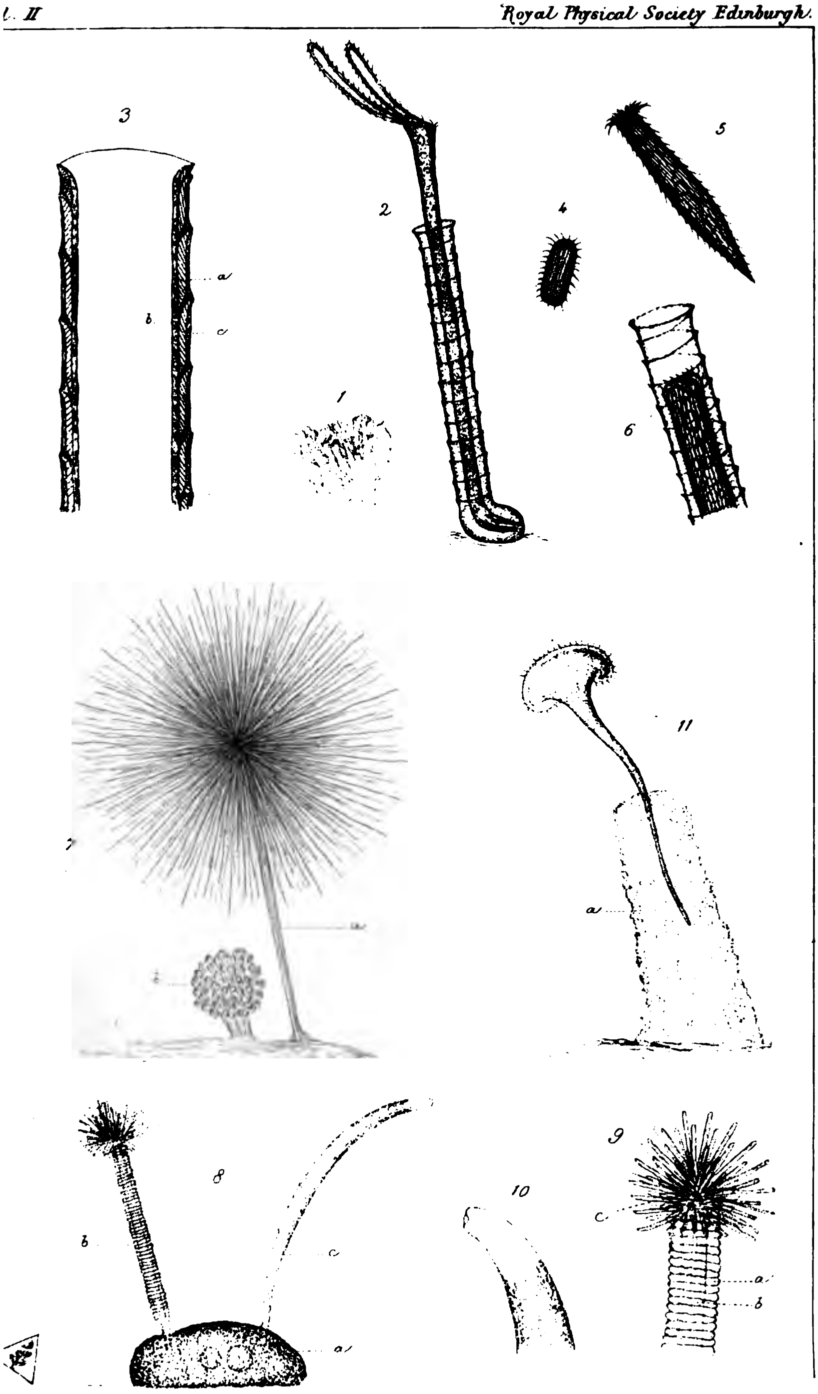

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New Protozoa.

PLATE III.

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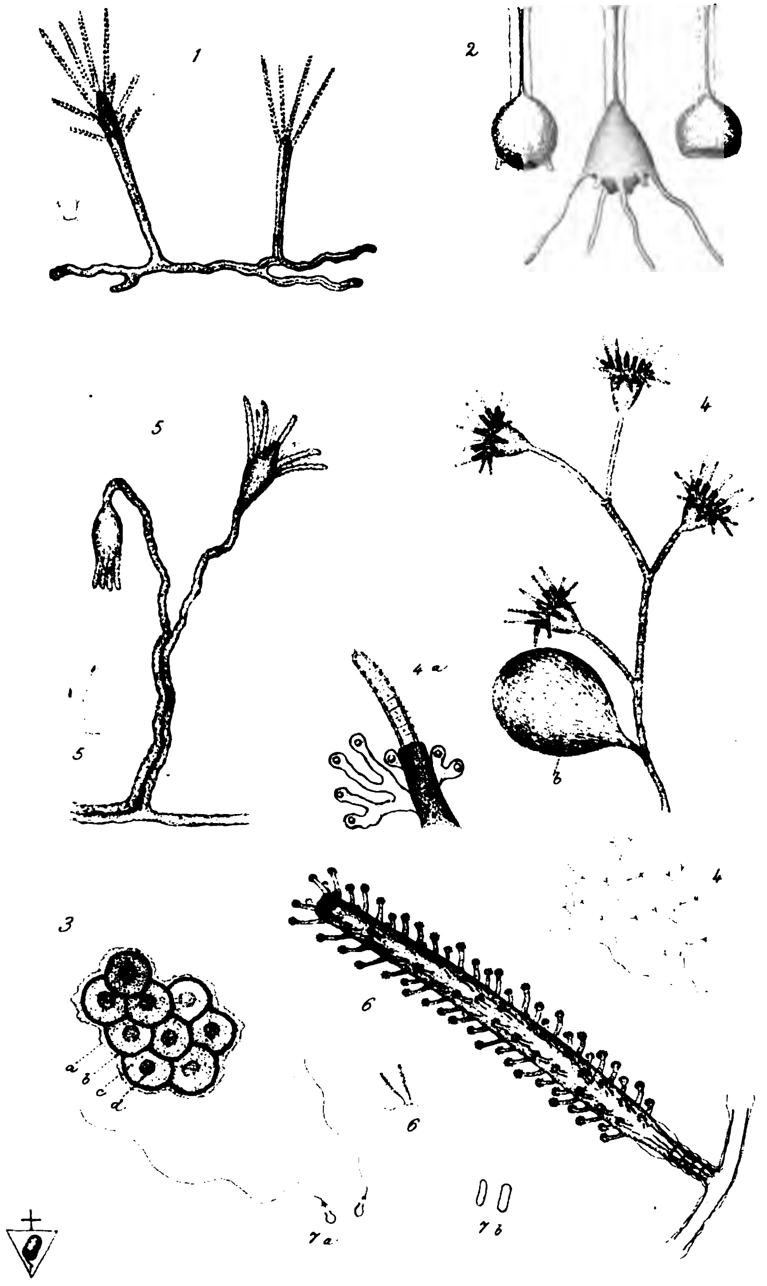

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British Zoophytes.

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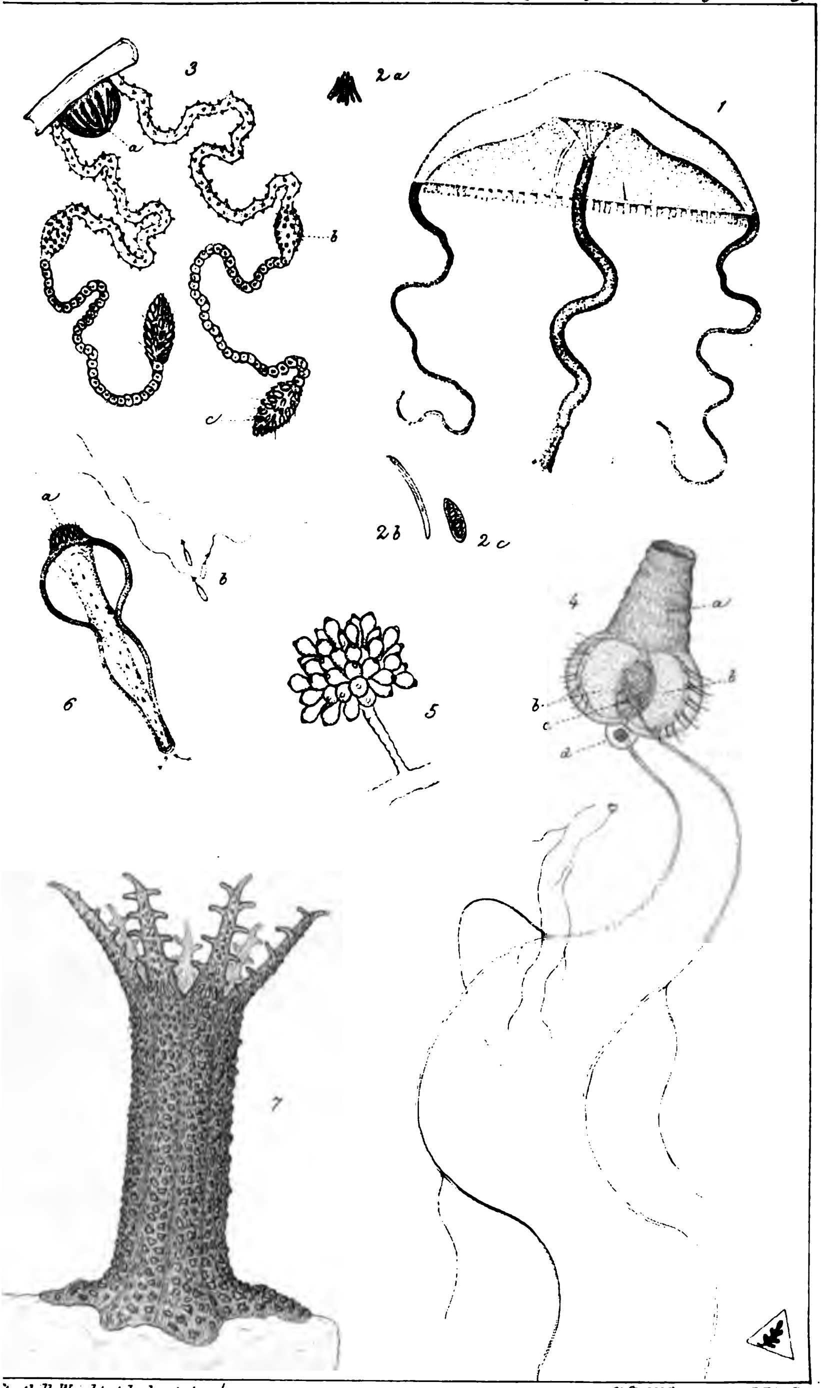

trethill Wright etched on stone. W. H. McFarlane Lith. Edr.

British Zoophytes.

PLATE V.

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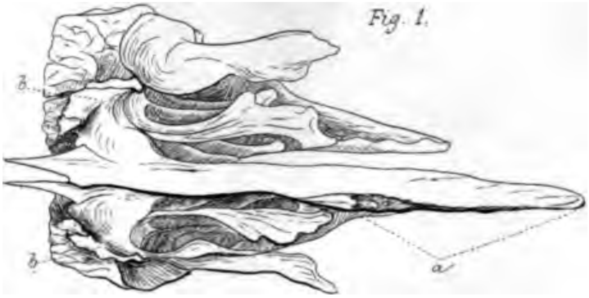

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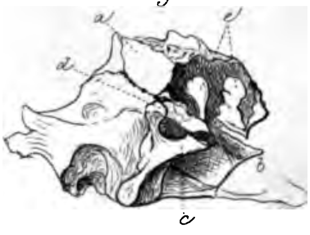

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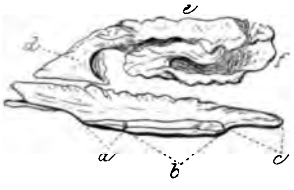

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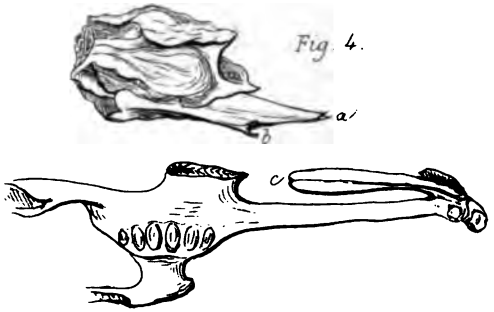

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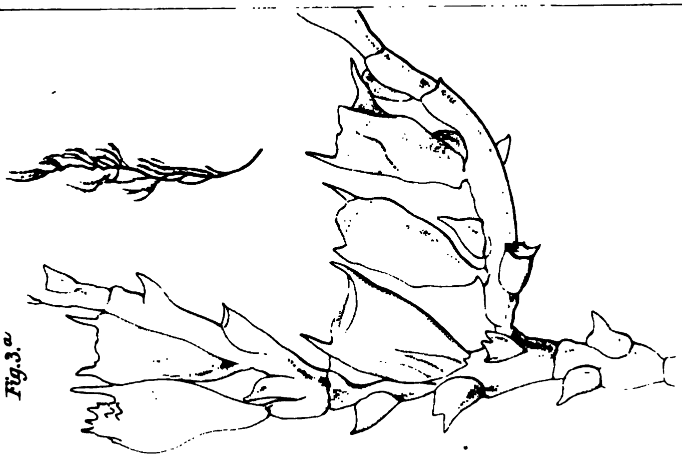
W H McFarlane, Lith^r Edin^r

PLATE VI.

*Royal Physical Society, Edinburgh.*

Fig. 3.



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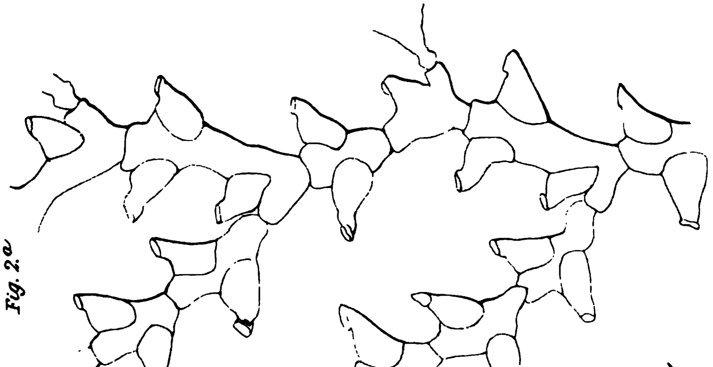

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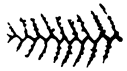

Fig. 2

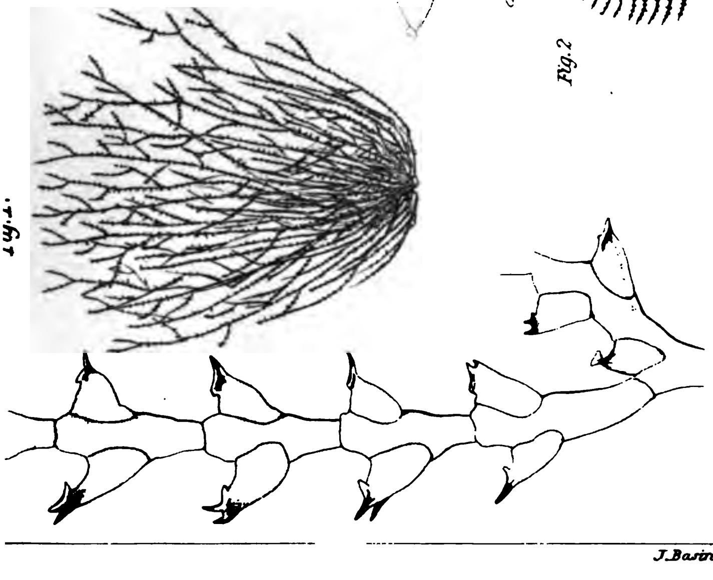

Fig. 1.

J. Basire, Sc.

PLATE VII.

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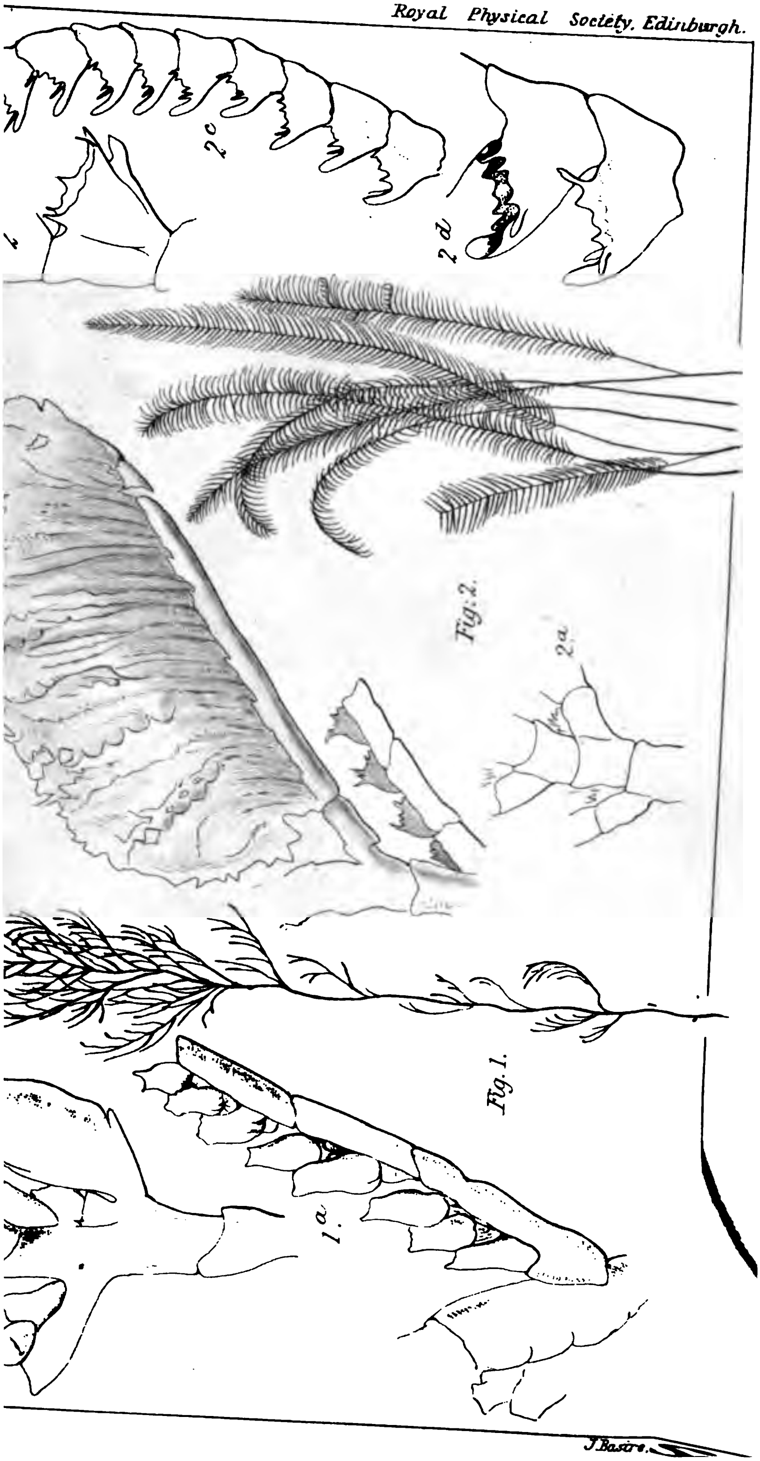

J Basire.

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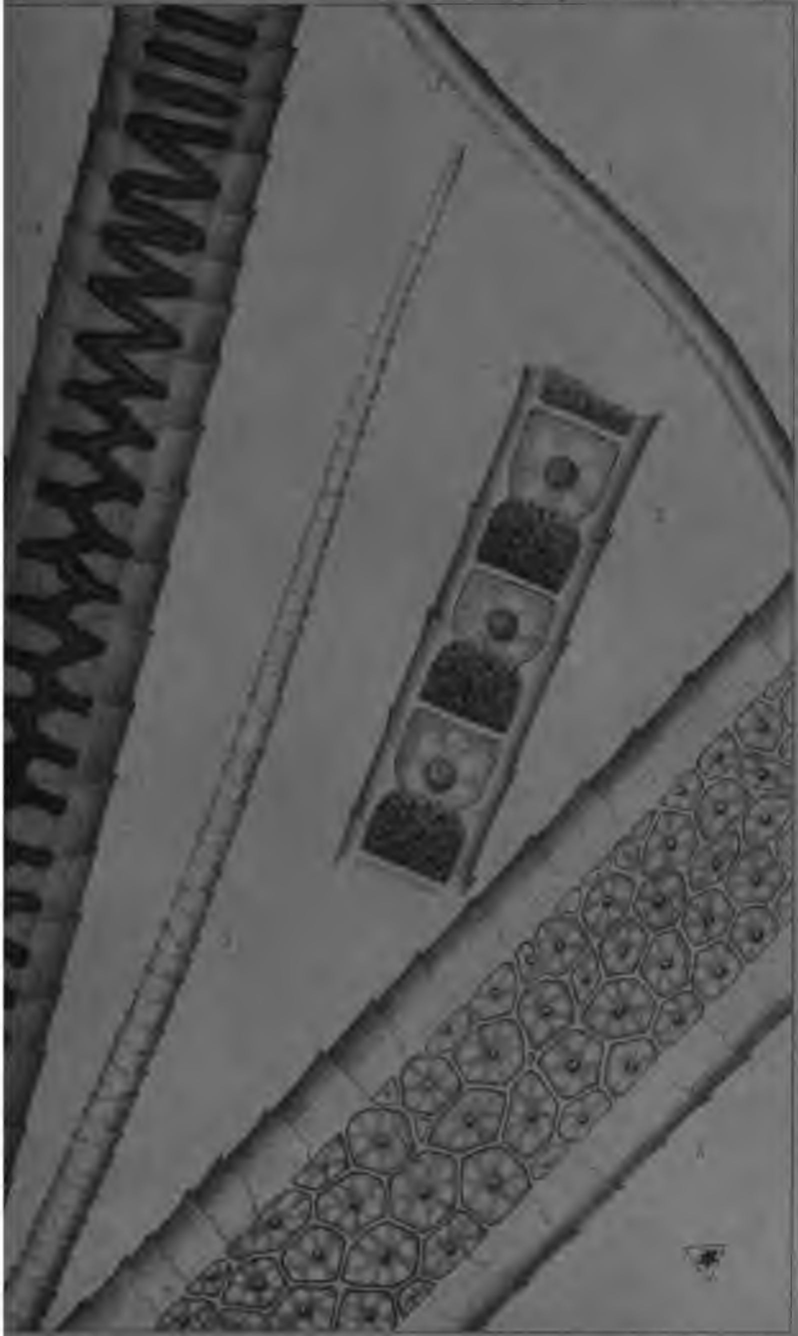
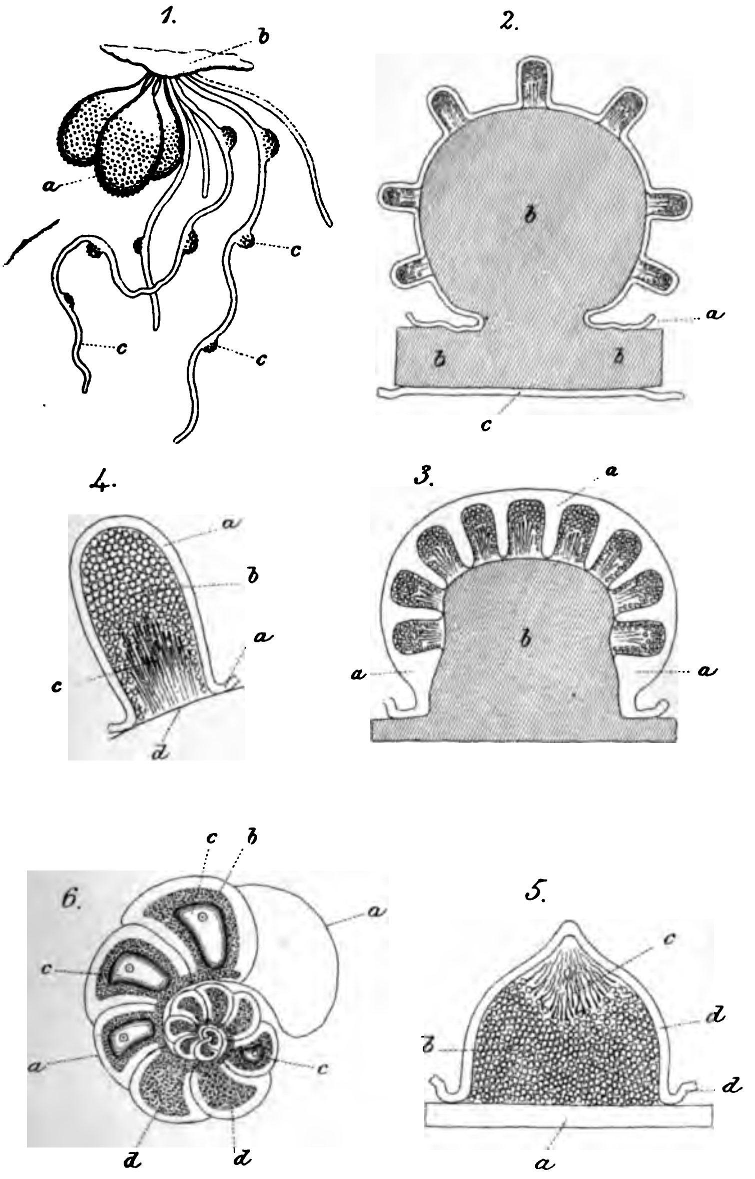


Hair of Angwantibo

PLATE IX.



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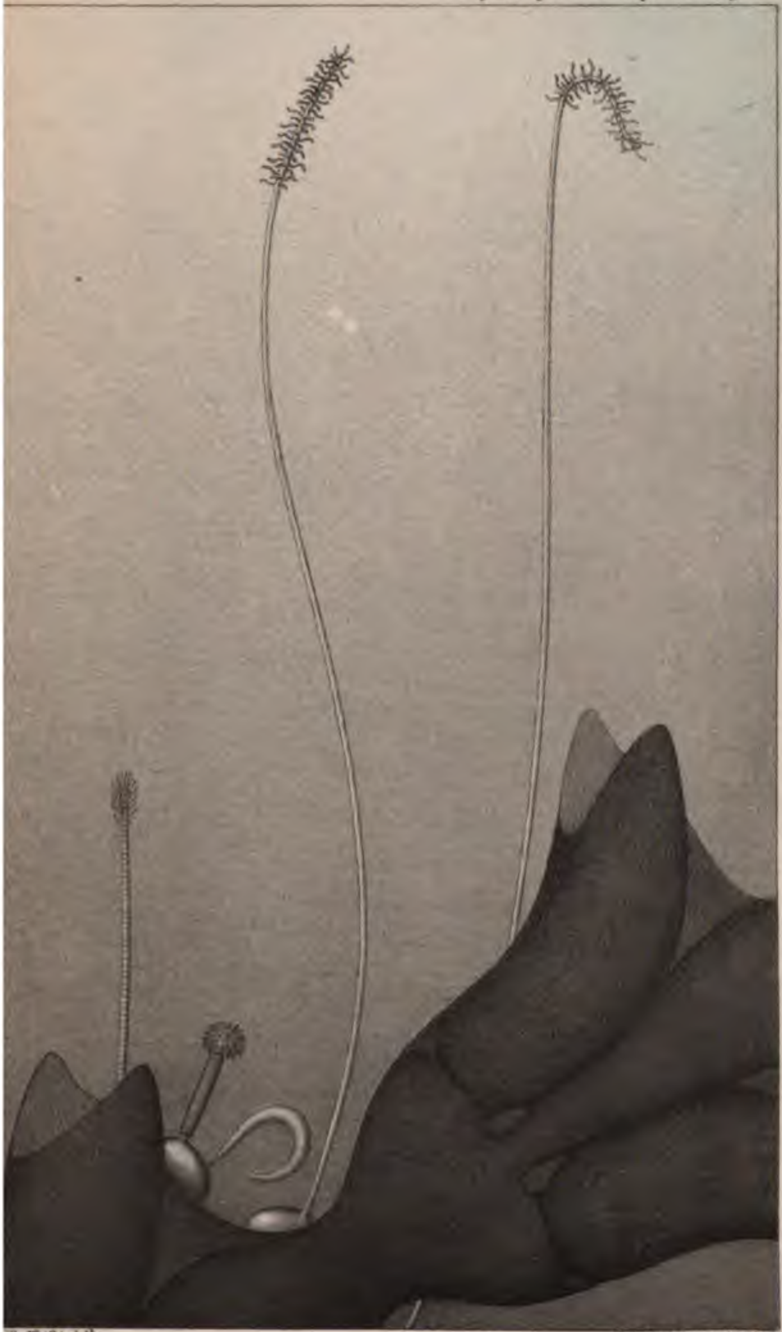
1-5 Reproduction of Chrysaora. 6. Reproduction of Truncatulina.

PLATE X.

I. Royal Physical Society, Edinburgh.

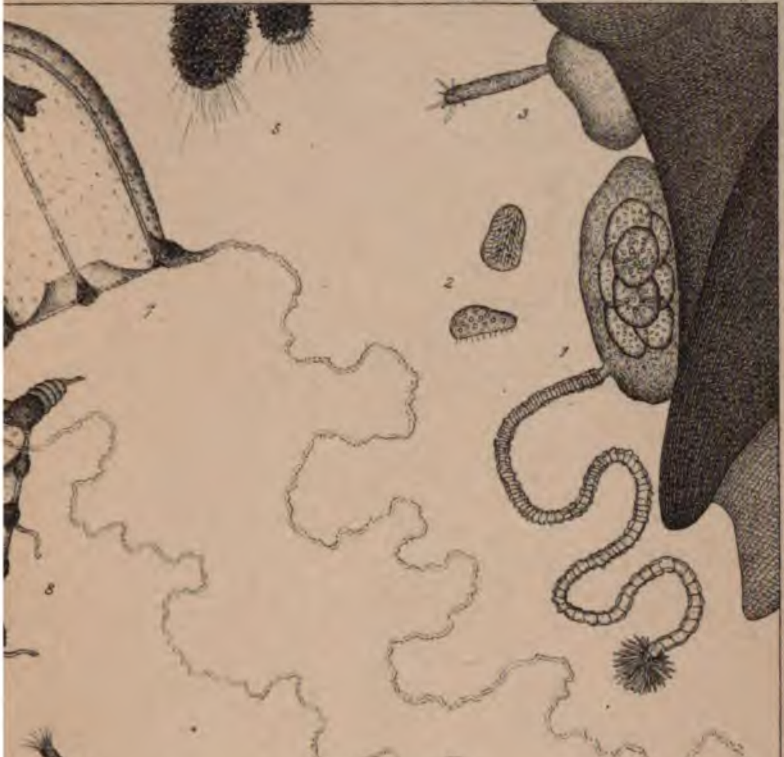


ill Wright, delt W. R. McFarlane, Lithr Edinr

Ophryodendron.

PLATE XI.

II. *Royal Physical Society, Edinburgh.*



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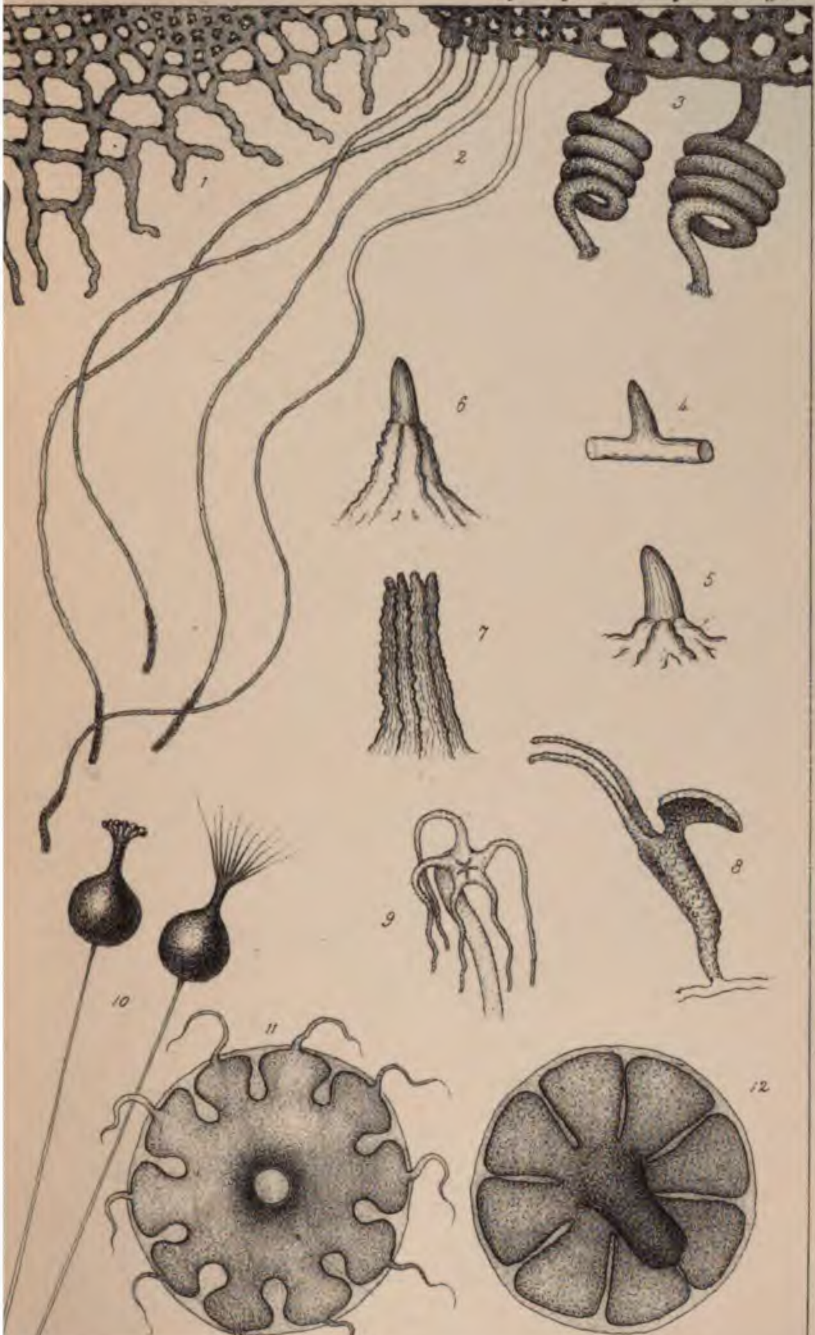
1-3. Ophryodendron. 4.5 Dendrophrya.
6-8. Atractylis palliata.

# PLATE XII.

ol. II. Royal Physical Society Edinburgh.



Strethill Wright del$^{t}$ et lith.

W. H. M$^{c}$ Farlane, Lith$^{r}$ Edin$^{r}$

1-7. Hydractinia. 8. Lar Sabellarum. 9. Trichydra pudica.
11. Cunina globosa. 12. Sertalaria pumila.

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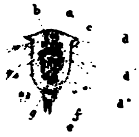

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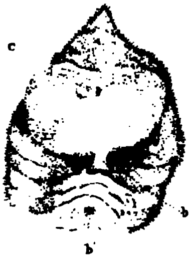

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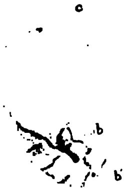

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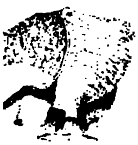

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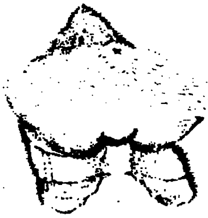

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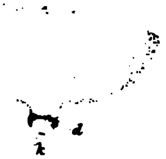

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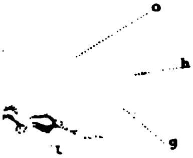

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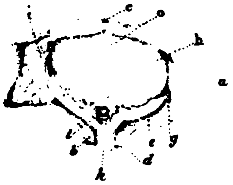

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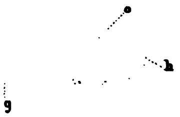

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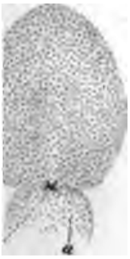

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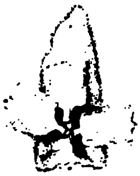
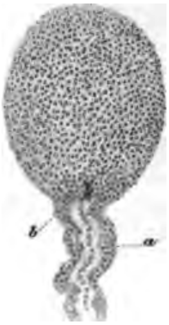
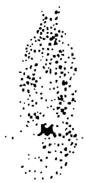


8



5

9



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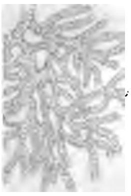

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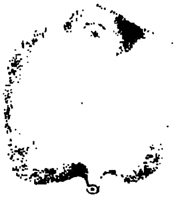


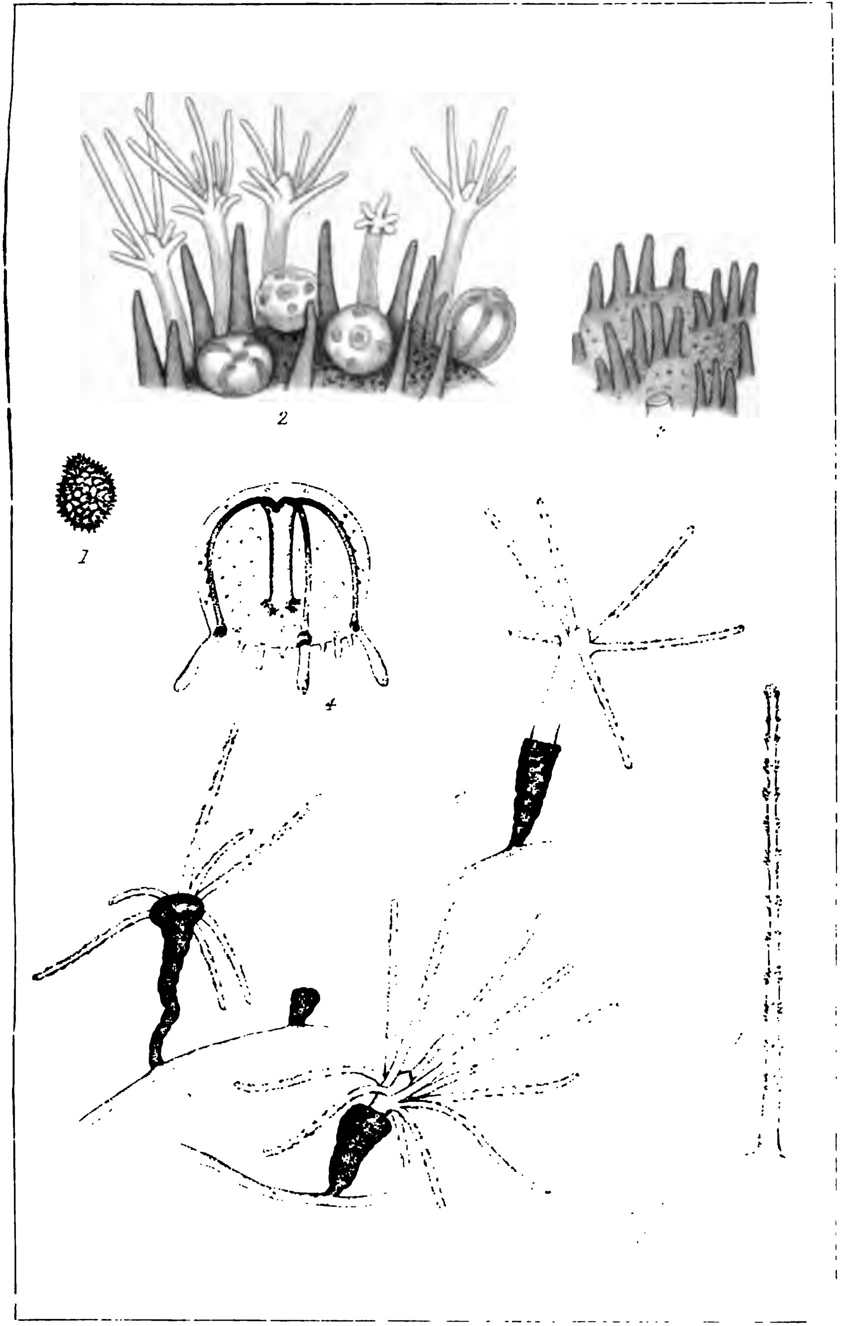
16

J. Anderson.

SACCULINA.

*Plate XIV.*

*Royal Physical Society, Edinburgh.*

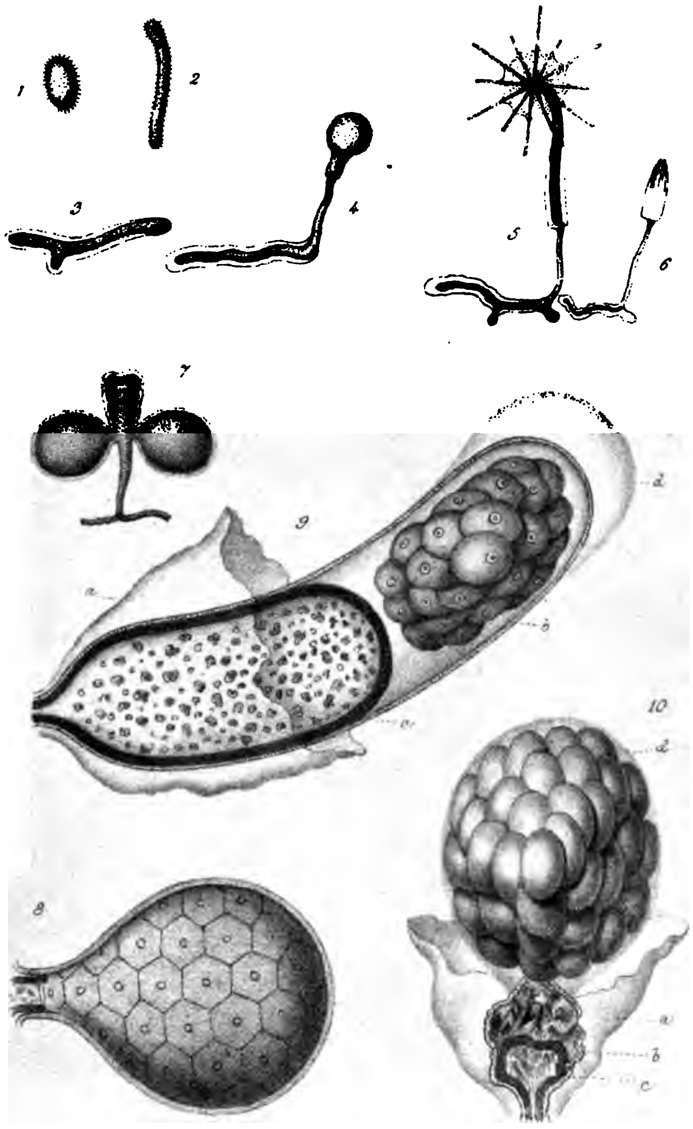


*J. Alder del.* [illegible]

**HYDRACTINIA AREOLATA, 1–4.**

**ATRACTYLIS ARENOSA, 5–7.**

PLATE XV.

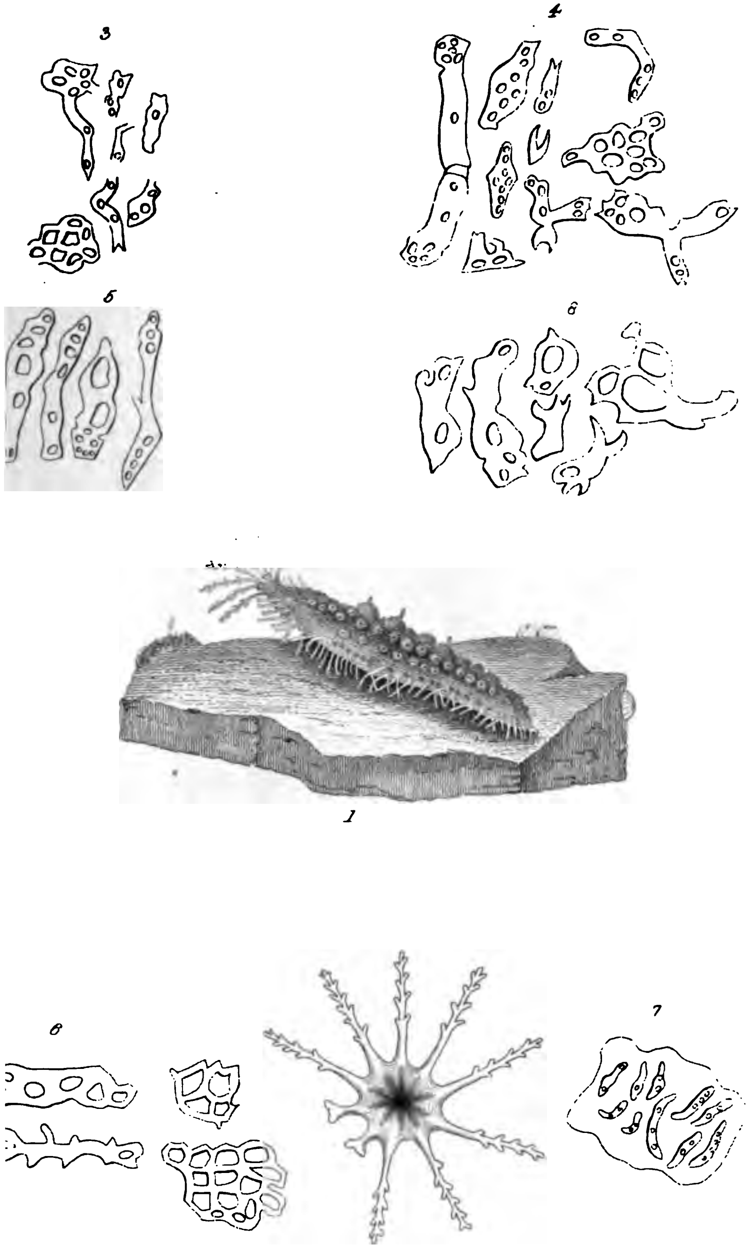


rshall Wright, del.t W H M'Farlane, Lith.

1-6. Æquoria vitrina. 7-10 Atractylis arenosa.

*Plate XVI.*

*Royal Physical Society, Edinbu*



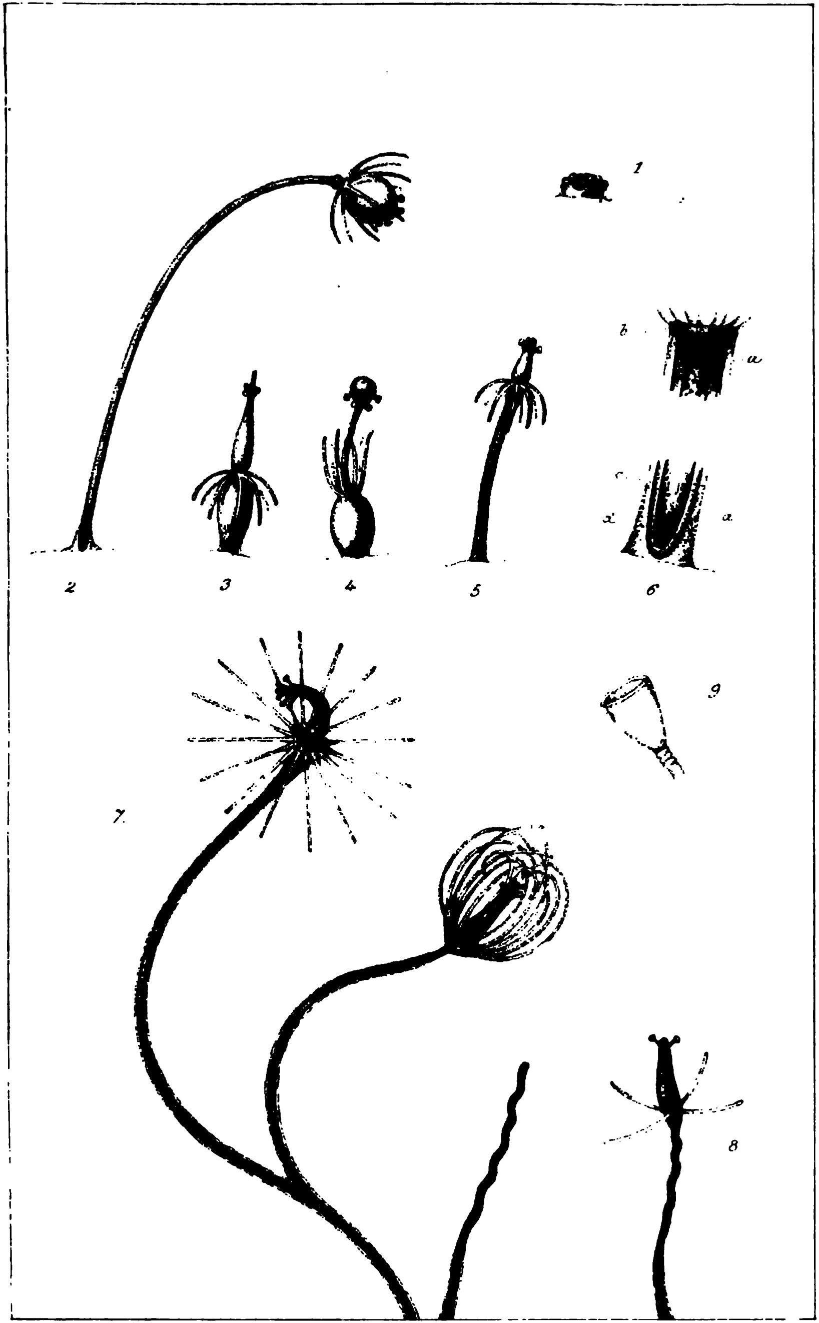
*n M.D. del.*

**HOLOTHURIA.**

*J.Ea*

PLATE XVII.

*Vol. II.* *Royal Physical Society. Edinburgh.*

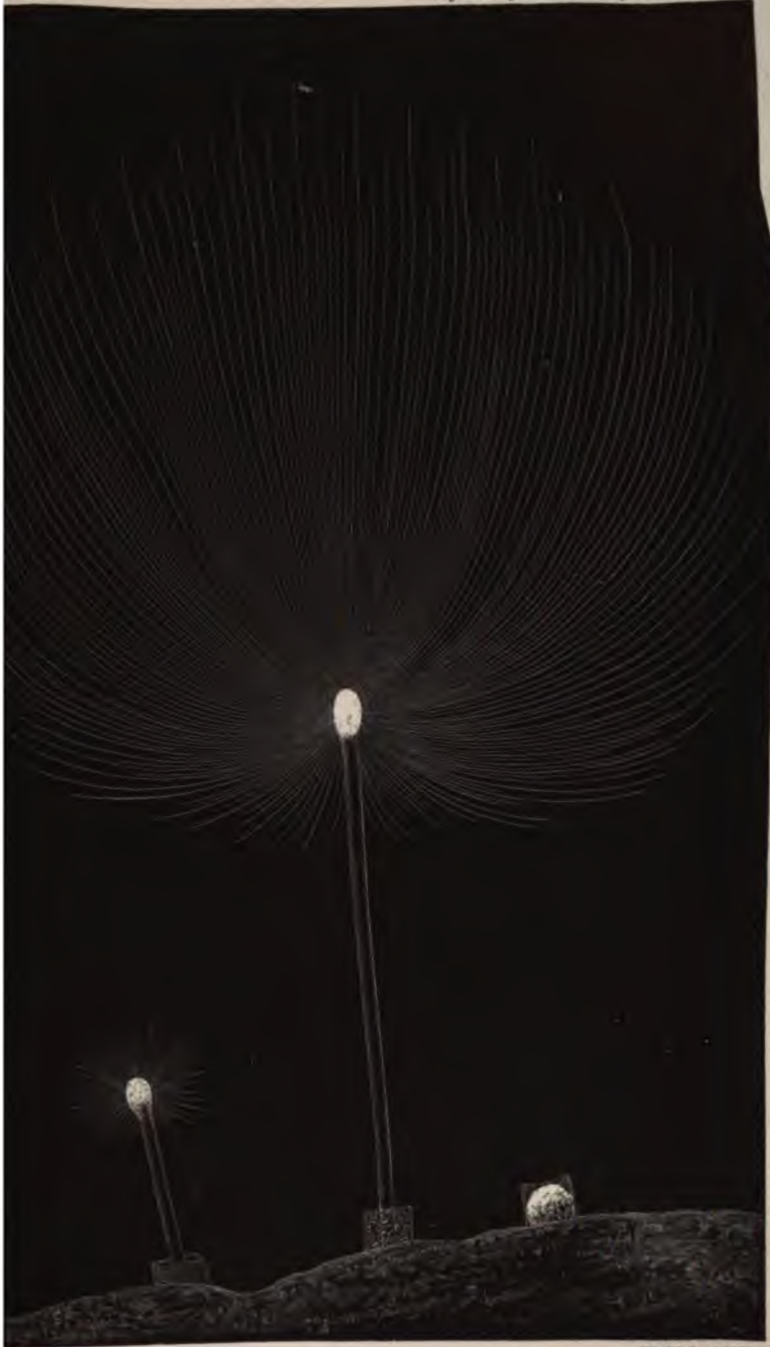


T. Strethill Wright, del. W. H. McFarlane, Lith. Edin.

1-6. Vorticlava Proteus. 7. 8. Acharadria larynx.

PLATE XVIII.

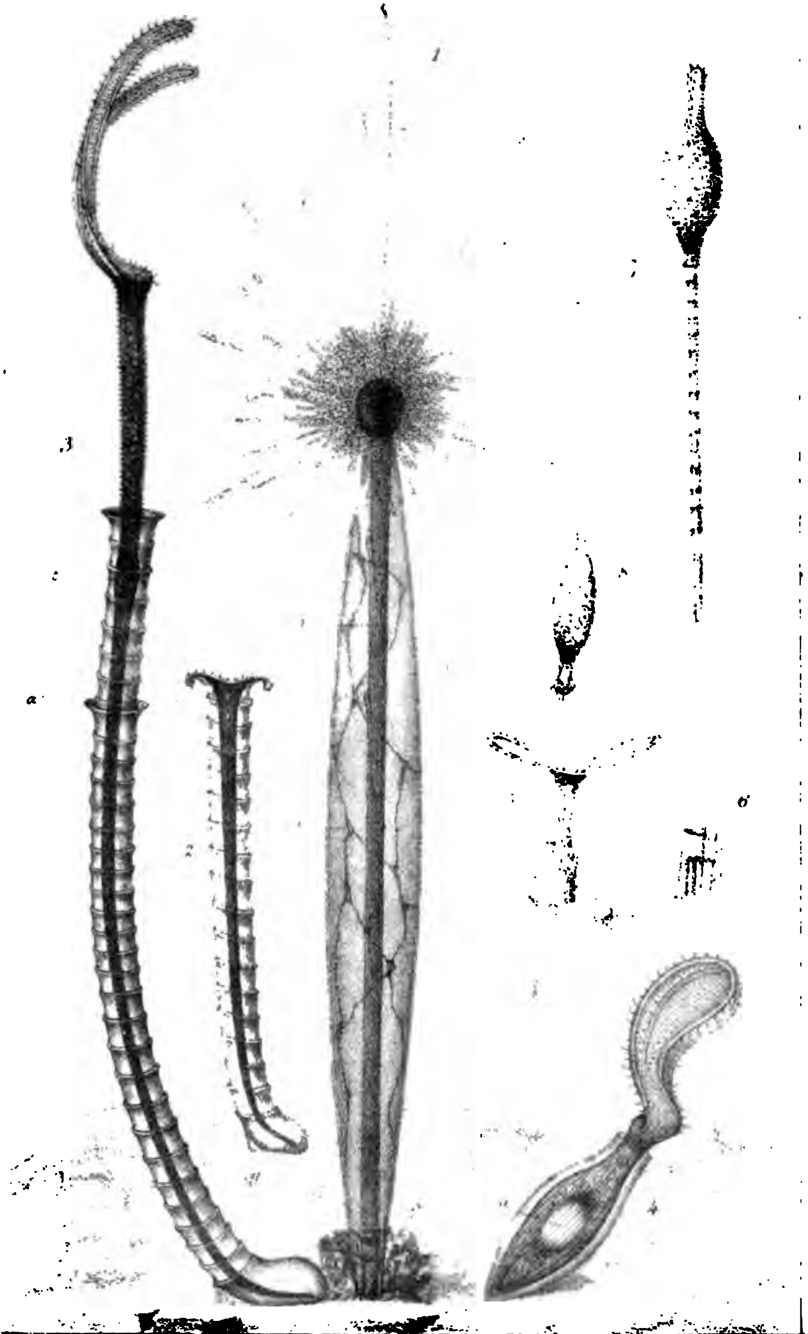
*Royal Physical Society, Edinburgh.*



Wright, del$^t$

W H M$^c$ Farlane Lith$^r$ Edin$^r$

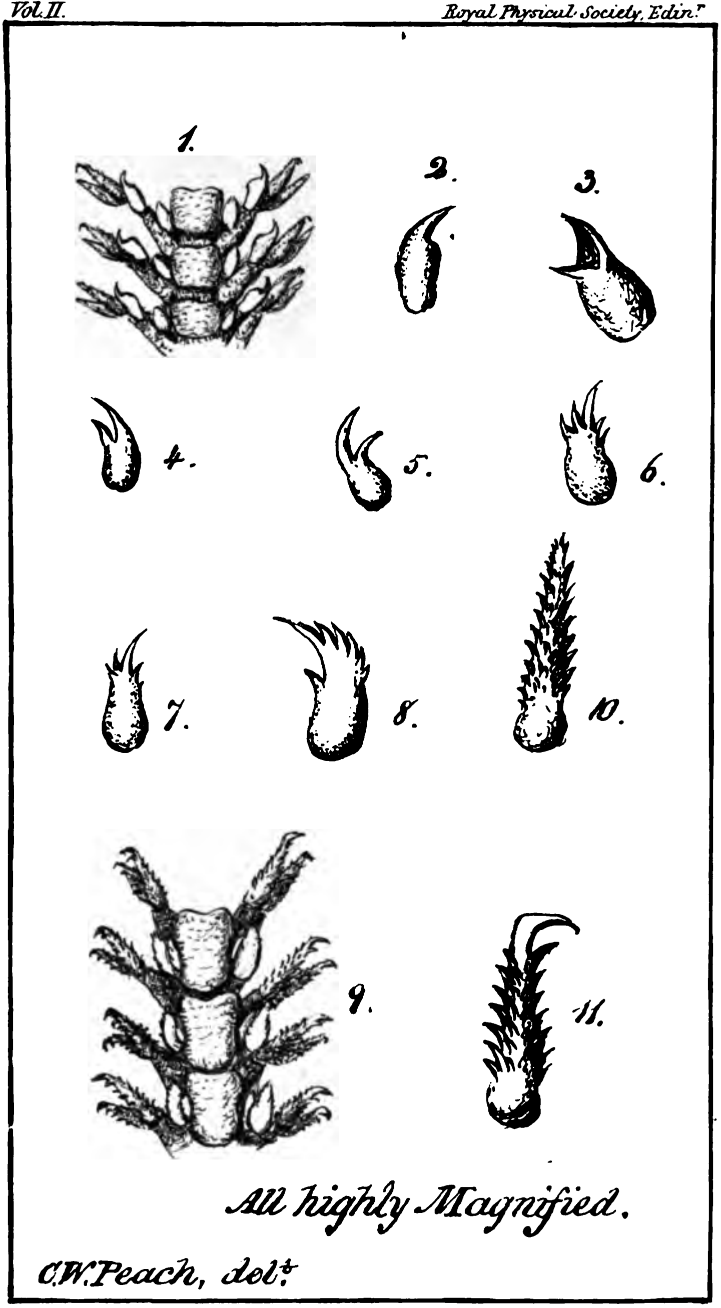
Zooteirea religata.



Strethill Wright del. W. H. McFarlane, Lith.

1. Zooteirea religata. 2.3. Freya producta 4 Freya obstetrica
5.6. Freya stylifer. 7.8 [illegible] [illegible]

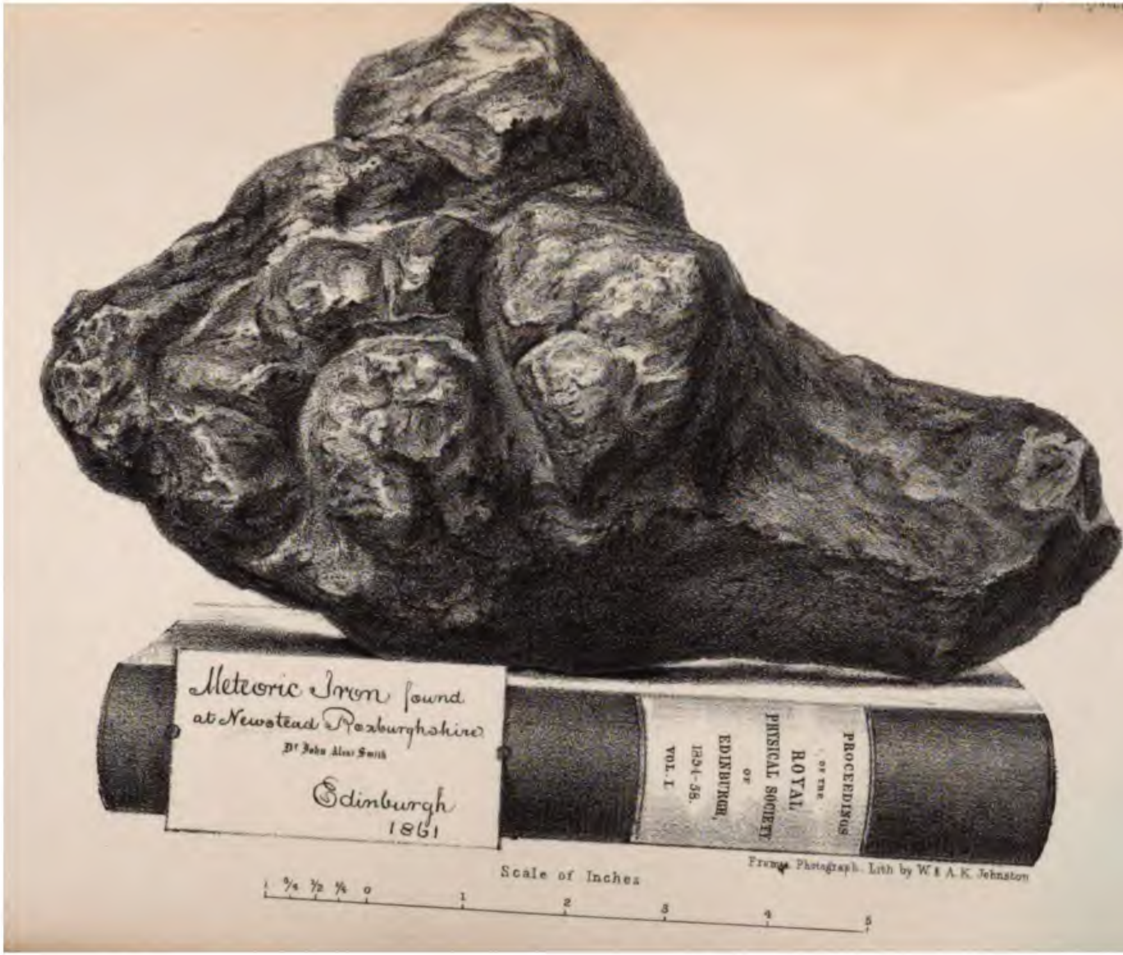
# PLATE XX



All highly Magnified.

C.W. Peach, del.t

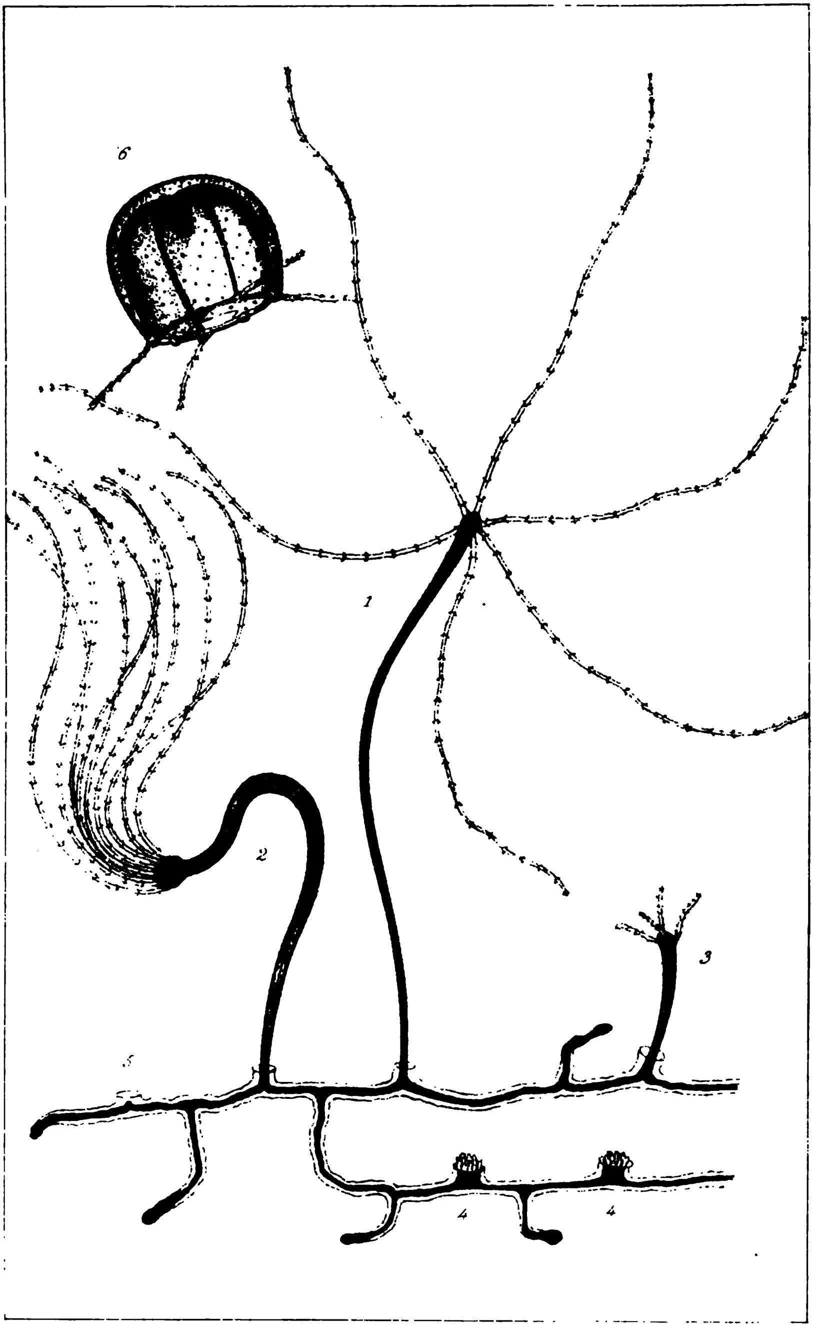
Society Edinburgh



From a Photograph. Lith by W & A.K. Johnston

PLATE XXII.

*Vol. II.* *Royal Physical Society Edinburgh.*



T. Strethill Wright del.
W. H. McFarlane Lithr Edinr

Trichydra pudica.

570.6
R887

Royal physical society of Edinburgh.
Proceedings. 265826, v.2, 1859/62

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